PLANETARY ATMOSPHERES

A CONTINUING BIBLIOGRAPHY

WITH INDEXES

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA SP-7017(01)

PLANETARY ATMOSPHERES

A CONTINUING BIBLIOGRAPHY
WITH INDEXES

A selection of annotated references to unclas-
sified reports and journal articles that were
introduced into the NASA Information System
during the period February, 1965–May, 1966.

INTRODUCTION

With the publication of this first supplement, NASA SP-7017(01), to the original issue of the Continuing Bibliography on "Planetary Atmospheres" (NASA SP-7017), the National Aeronautics and Space Administration continues its program of distributing selected references to reports and articles on aerospace topics that are currently under intensive study. The references are assembled in this form to provide a convenient source of information for use by scientists and engineers who need this kind of specialized compilation. Continuing Bibliographies are updated periodically by supplements which can be appended to the original issue.

With respect to particular subjects, the majority of entries in this publication pertain to investigations of Mars and Venus, and a large percentage of these references were produced as a result of the successful probes of the atmospheres of Venus (Mariner II) and Mars (Mariner IV). In addition, a limited number of references to the atmospheres of Jupiter, Mercury, and Saturn is also included. The scope of coverage was defined to permit inclusion of references to such specific topics as the theory of planetary origins, extraterrestrial environment, planetary exploration and spacecraft reentry, and the physical properties of the planets. Pertinent references to the techniques of planetary observation and measurement, e.g., those involving photography, photometry, spectroscopy, astronomy, and meteorology, are also to be found in this bibliography. All references included in SP-7017(01) have been announced in either *Scientific and Technical Aerospace Reports (STAR)*, *International Aerospace Abstracts (IAA)* or the NASA Continuing Bibliography *Aerospace Medicine and Biology* (NASA SP-7011 and its supplements), and were introduced into the NASA information system during the period February, 1965–May, 1966.

Each entry in the bibliography consists of a citation and an abstract. The listing of entries is arranged in three major groups. Report literature references are contained in the first group and are subdivided according to their date of announcement in *STAR*. The second group includes journal and book references that have been announced in *IAA*. A third group is comprised of entries that were originally prepared by the Aerospace Medicine and Biology Bibliography Section of the Library of Congress (LC) for inclusion in *Aerospace Medicine and Biology*.

A subject index and a personal author index are included.

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Washington, D.C. 20546

Collections of NASA documents are currently on file in the organizations listed on the inside of the back cover.

(continued)

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All articles listed are available from the American Institute of Aeronautics and Astronautics, Technical Information Service. Individual and Corporate AIAA Members in the United States and Canada may borrow publications without charge. Interlibrary loan privileges are extended to the libraries of government agencies and of academic non-profit institutions in the United States and Canada. Loan requests may be made by mail, telephone, telegram, or in person. Additional information about lending, photocopying, and reference service will be furnished on request. Address all inquiries to:

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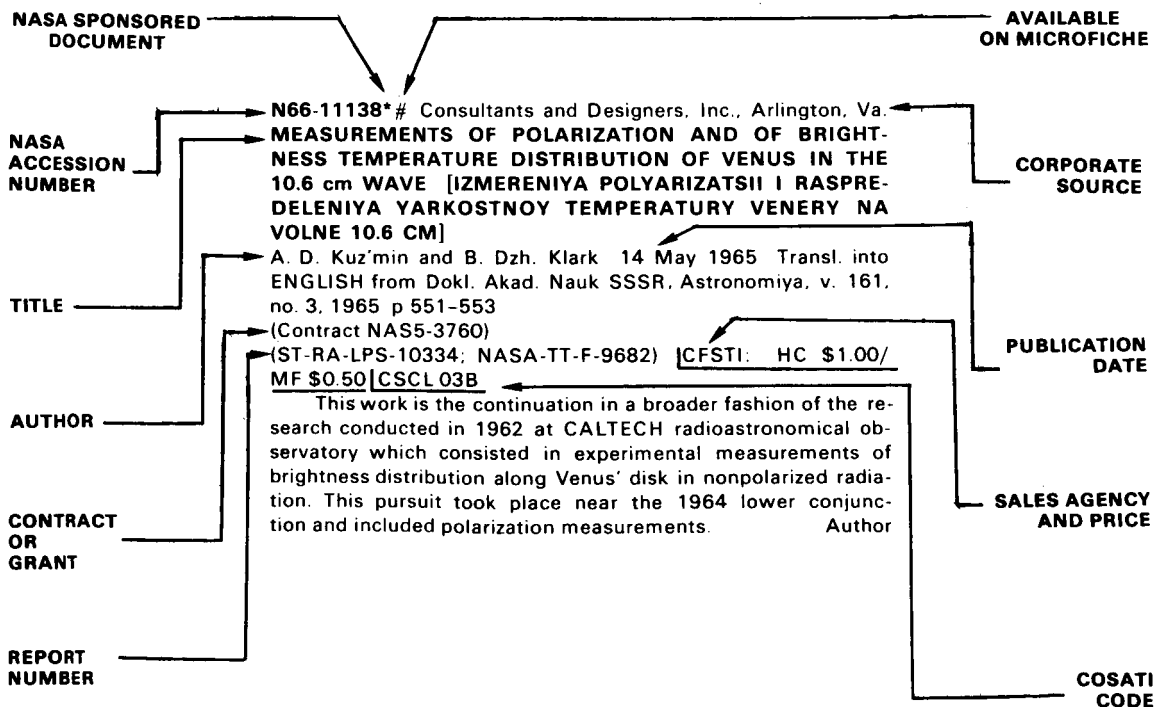750 Third Avenue, New York 17, New York

For further details please consult the *Introductions* to *STAR* and *IAA*, respectively.
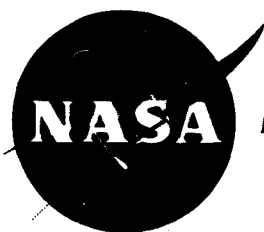

LC Entries

Articles listed are available in the journals in which they appeared. They may be borrowed or consulted in libraries maintaining sets of these journals. In some instances, reprints may be available from the journal offices.

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N66-11138*# Consultants and Designers, Inc., Arlington, Va.
MEASUREMENTS OF POLARIZATION AND OF BRIGHT-
NESS TEMPERATURE DISTRIBUTION OF VENUS IN THE
10.6 cm WAVE [IZMERENIYA POLYARIZATSII I RASPRE-
DELENIYA YARKOSTNOY TEMPERATURY VENERY NA
VOLNE 10.6 CM]

CORPORATE
SOURCE

A. D. Kuz'min and B. Dzh. Klark   14 May 1965 Transl. into
ENGLISH from Dokl. Akad. Nauk SSSR, Astronomiya, v. 161,
no. 3, 1965 p 551–553

TITLE

(Contract NAS5-3760)

(ST-RA-LPS-10334; NASA-TT-F-9682) [CFSTI: HC $1.00/
MF $0.50 [CSCL 03B

PUBLICATION
DATE

AUTHOR

    This work is the continuation in a broader fashion of the re-
search conducted in 1962 at CALTECH radioastronomical ob-
servatory which consisted in experimental measurements of
brightness distribution along Venus' disk in nonpolarized radia-
tion. This pursuit took place near the 1964 lower conjunc-
tion and included polarization measurements.   Author

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REPORT
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STAR ENTRIES

vehicles. Uncertainties in the atmosphere composition and scale height are shown to preclude accurate prediction of the heating rates for an -unmanned probe entry. However, as expected, requirements for soft landings are the most restrictive. Already difficult to satisfy because of low surface pressure, these requirements become extremely limiting because of the uncertainty in atmosphere structure.   Author

N65-13519#   General Electric Co., Philadelphia, Pa. Space Sciences Lab.
NORMAL SHOCK PARAMETERS FOR THE VENUSIAN ATMOSPHERE
F. Bosworth, C. Cook, L. Gilbert, and S. Scala   Dec. 1964
60 p refs
(R64SD65)
    Normal shock wave and stagnation point solutions for four Venusian atmospheric and chemical models are presented which cover a range of flight speeds from 10000 to 40000 fps, and a range of altitudes from 50000 to 430000 ft. Singly ionized chemical species are included in the analysis and in the numerical solution of the thermochemical equations. Curves of dimensionless pressure, temperature, and density of the shocked gas are presented as functions of flight speed for constant altitudes.   Author

N65-14417*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THEORETICAL MODEL ATMOSPHERES OF VENUS
Robert B. Owen   Washington, NASA, Jan. 1965   46 p   refs
(NASA-TN-D-2527)   OTS: HC $2.00/MF $0.50
    From a survey of past and present literature, a summation of various models of the atmosphere of Venus is presented. It is shown how these models were formed and eliminated; and a final model, apparently more consistent with recent observations, is advocated. This model, one of the greenhouse variety, indicates more extreme surface conditions than were previously suspected.   Author

N65-14628*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME EFFECTS OF UNCERTAINTIES IN ATMOSPHERE STRUCTURE AND CHEMICAL COMPOSITION ON ENTRY INTO MARS
Robert L. Mc Kenzie Washington, NASA, Jan. 1965 36 p refs
(NASA-TN-D-2584) OTS: HC $2.00/MF $0.50
    Provided are examples of the degree to which uncertainties in the structure and composition of the Martian atmosphere affect various aspects of entry. The discussion contains the effects on manned-vehicle entry corridors, aerodynamic heating, including shock-layer radiation for an unmanned probe-type entry, and vehicle design requirements for an unmanned probe soft landing. The results indicate that current uncertainties in atmosphere scale height are significant in that they greatly decrease the entry corridor heights for manned

N65-14653*# New Mexico U., University Park.   Research Center
OBSERVATIONS OF THE RED SPOT ON JUPITER
Bradford A. Smith and Clyde W. Tombaugh   15 Apr. 1963
8 p ref
(Grant NsG-142-61)
(NASA-CR-50303; TN-557-63-2) OTS: HC $1.00/MF $0.50
    Unfiltered photographs on blue plates were made of the red spot on Jupiter between June 1962 and January 1963. Two separate estimates of the average transit image on each of the plates were made and converted to the proper System II longitude of Jupiter. A red spot acceleration was observed around November 10, 1962. The longitude of the red spot increased at a rate of 0.025 ± 0.008 degrees daily until the middle of January 1963. A major, rapidly spreading disturbance in the south equatorial belt was detected in September 1962 and made contact with the red spot in the first week of November. No definite evidence was found that the red spot acceleration was directly related to the south equatorial disturbance.   G.G.

N65-14655*# Geophysics Corp. of America, Bedford, Mass.
THE EFFECT OF CLOUDINESS ON A GREENHOUSE MODEL OF THE VENUS ATMOSPHERE
George Ohring and Joseph Mariano   May 1963   33 p   refs
(Contract NASw-704)
(NASA-CR-51176; GCA-TR-63-17-N) OTS: HC $2.00/MF $0.50
    In previous models of the greenhouse effect in the Venus atmosphere, it has been assumed that infrared-absorbing atmospheric gases provide the sole contribution to the infrared opacity of the Venus atmosphere. In the present study, the influence of an extensive cloud cover, opaque to infrared radiation, is also included in the greenhouse model. The magnitude of the greenhouse effect, which is defined as the ratio of the surface temperature produced by the greenhouse to the surface temperature of an atmosphereless Venus, is computed as a function of infrared opacity of the atmosphere, and amount and height (actually ratio of cloud-top pressure to surface pressure) of clouds. It is assumed that the Venus atmosphere is grey, the absorbing gas has a constant mixing ratio, and the temperature variation with altitude is linear. Calculations are made for two temperature lapse rates: the adiabatic lapse rate, and nine-tenths of the adiabatic lapse rate.   Author

N65-14673* Israel Program for Scientific Translations, Ltd., Jerusalem.
THE NATURE OF THE PLANETS
V. V. Sharonov 1964 426 p refs Transl. into ENGLISH of the book "Priroda Planet" Moscow, Gos. Izd. Fiz.-Mat. Lit., 1958 Published for NASA and NSF
(NASA-TT-F-77) OTS: $4.25

The nature of planets and satellites in the solar system is comprehensively treated from the practical or observational viewpoint. Topics covered include: (1) the solar system as an object of physical investigation; (2) telescopic investigation of the surface of planets and satellites, along with their geometrical and mechanical characteristics; (3) planetary cartography and topographic descriptions of individual bodies in the solar system; (4) integrated-light photometry, and photometry of planetary disks; (5) optics of planetary atmospheres, and physical conditions on planets and satellites. A bibliography is given for each chapter, and the appendix lists the terminology recommended by the Commission on Planetary Physics of the Astronomy Board at the U.S.S.R. Academy of Sciences.
M.G.J.

N65-15023 RAND Corp., Santa Monica, Calif.
ATMOSPHERES OF THE PLANETS
G. F. Schilling Sep. 1964 30 p refs Submitted for Publication
(P-2964; AD-606026)

Known facts and proposed theories about the atmospheres of the various planets are presented in a general manner. In particular, an attempt is made to emphasize the causes and reasons why the planetary atmospheres still present a deep mystery as to their existence and makeup.
P.V.E.

N65-15223*# Arizona U., Tucson. Lunar and Planetary Lab.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME 2, NUMBERS 31–35: MARS ISSUE
Gerard P. Kuiper, T. C. Owen, Dale P. Cruikshank, and James V. Marshall 1964 98 p refs
(Grant NsG-161)
(NASA-CR-60264) OTS: HC $3.00/MF $0.75

Four papers on the atmosphere of Mars and one on laboratory spectra of various gases are presented. In the first paper, spectra of the planet Mars obtained from the 82-in. telescope of the McDonald Observatory are presented for the interval 1μ to 2.5μ, and the spectra are examined for the presence of constituents other than CO_2. In the second paper, the Mars spectra reported in the first paper are calibrated with laboratory spectra of pure CO_2 and of mixtures of CO_2 with N_2 and Ar, and preliminary values are derived for the pressure of the Martian atmosphere and the total amount of gases other than CO_2. The third paper presents two independent determinations of the CO_2 content of the Martian atmosphere, derived from the Mt. Wilson plate obtained in 1964 by Kaplan, Münch, and Spinrad. The fourth paper presents laboratory spectra of the region 1μ to 2.5μ for testing the presence of CH_4, NH_3, N_2O, CO, and COS in planetary atmospheres. A new investigation of the reported presence of NO_2 in the Martian atmosphere is discussed in the fifth paper, and it is concluded that the upper limit on a vertical column of NO_2 on Mars is about 8 micronatm.
D.E.W.

N65-15288# Lowell Observatory, Flagstaff, Ariz.
PHYSICAL RESEARCHES ON THE BRIGHTER PLANETS
Final Report
William M. Sinton 30 Sep. 1964 20 p refs
(Contract AF 19(604)-5874)
(AFCRL-64-926; AD-609547)

Observational studies of the planets and the moon through the use of photography, photoelectric photometry, infrared radiometry, and infrared spectroscopy were made. The resulting data include the measurements of the thickness of dust on the floors of 16 lunar craters; the infrared radiometric temperatures of Mercury, Venus, Mars, Jupiter, Saturn, and Uranus; and extensive photoelectric photometry of Mars. Some of the important conclusions that have been previously published are included.
Author

N65-15370*# AVCO-Everett Research Lab., Everett, Mass.
THE SPECTRUM OF SHOCK-HEATED GASES SIMULATING THE VENUS ATMOSPHERE
A. Fairbairn Jul. 1963 15 p refs Presented at the AIAA Conf. on Phys. of Entry into Planetary Atmosphere, Cambridge, Mass., 26–28 Aug. 1963
(Contract NASw-748)
(NASA-CR-51668; AVCO-Everett Res. Note-371) OTS: HC $1.00/MF $0.50

Mixtures of 90% N_2 plus 10% CO_2, and 80% N_2 plus 20% CO_2 were heated by reflected shock waves to temperatures of about 8000° K and normal density. Photographic and photoelectric measurements were made of the emitted radiation in the region 0.23μ to 1.2μ. The CN radical is the most prominent radiator in these experiments, and the intensity of the emission may be used to derive transition probabilities for the violet and red systems of bands.
Author

N65-15488*# Virginia Polytechnic Inst., Blacksburg.
CONFERENCE ON ARTIFICIAL SATELLITES, PART B
Aug. 1964 295 p refs Conf. held at Va. Polytech. Inst., Blacksburg, 12–16 Aug. 1963 Its Bull., Eng. Expt. Sta. Ser. No. 156, Vol. 57, No. 8
(Contract NASr-226)
(NASA-CR-60132) OTS: HC $6.00/MF $1.50

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SOLAR SPACE ENVIRONMENT
1. THE ORBITING ASTRONOMICAL OBSERVATORY AND THE ORBITING SOLAR OBSERVATORY N. G. Roman (NASA. Washington) 13 p (See N65-15489 06-30)
2. SOLAR AND STELLAR RADIATIONS ABOVE THE EARTH'S ATMOSPHERE T. A. Chubb (Naval Res. Lab.) 48 p (See N65-15490 06-29)
3. THE ATMOSPHERE AND SURFACE FEATURES OF MARS H. Spinrad (JPL) 20 p refs (See N65-15491 06-30)
4. SOLAR FLARES AND THE ASSOCIATED EJECTION OF PARTICLES E. Tandberg-Hanssen (High Altitude Observatory) 9 p (See N65-15492 06-29)

METEOROLOGICAL AND COMMUNICATION SATELLITES
5. TIROS — THE FIRST METEOROLOGICAL SATELLITE R. M. Rados (NASA. Goddard Space Flight Center) 55 p (See N65-15493 06-31)
6. THE NIMBUS SPACECRAFT SYSTEM H. Press (NASA. Goddard Space Flight Center) 61 p (See N65-15494 06-31)
7. PASSIVE COMMUNICATIONS SATELLITES W. J. O'Sullivan, Jr. (NASA. Langley Res. Center) 49 p ref (See N65-15495 06-31)
8. ACTIVE COMMUNICATION SATELLITE SYSTEM D. Mitchell (Bell Telephone Labs.) 31 p (See N65-15496 06-31)

N65-15491* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE ATMOSPHERE AND SURFACE FEATURES OF MARS
Hyron Spinrad In Va. Polytech. Inst. Conf. on Artificial Satellites, Pt. B. Aug. 1964 20 p refs (See N65-15488 06-31)
OTS: HC $6.00/MF $1.50

Gerard P. Kuiper [1964] 10 p refs
(Grant Nonr(G)-00014-64)
(AD-608352)

The major effort of the research was concerned with the atmospheres of Mars and Jupiter. A photographic spectrogram was calibrated using the 72-foot multiple-path absorption tube, and the abundance of CO_2 in the Martian atmosphere was derived. The result was 46 ±20 meter atm for an assumed Martian atmospheric temperature of 200° K. Studies on the determination of atmospheric pressure and of abundances of other gases are also reported. The analysis of the photographic spectrum of Jupiter was extended to longer and to shorter wavelengths. All of the planetary absorptions observed in the long wavelength region were due to either methane or ammonia. Upper limits were set on the abundances of a number of gases: acetylene, ethylene, ethane, methylamine, methyl deuteride, hydrocyanic acid, silane, and hydrogen deuteride. Low dispersion spectra of Saturn, Uranus, and Jupiter satellites Io and Ganymede were also studied.   D.S.G.

N65-17118*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A TECHNIQUE FOR DETERMINING PLANETARY ATMOSPHERE STRUCTURE FROM MEASURED ACCELERATIONS OF AN ENTRY VEHICLE
Victor L. Peterson Washington, NASA, Feb. 1965 22 p refs
(NASA-TN-D-2669) OTS: HC $1.00/MF $0.50

A detailed procedure was developed for obtaining the density and pressure structure of a planetary atmosphere from measurements of accelerations experienced by a vehicle, making an uncontrolled entry into the atmosphere. It was shown that simplification in the method is possible and a potentially large source of error is eliminated if the accelerometers are carried by a spherically shaped vehicle. Sample calculations were made to illustrate how well extreme model atmospheres for Mars could be defined by this technique. Results of the calculations showed that accelerometers designed to measure over the entire range of expected accelerations with an accuracy of 0.1% would not provide sufficiently precise data. If, however, the time period over which large errors in measured accelerations are encountered is reduced or the acceleration measurements are improved by resorting to a dual system in which one set of instruments measures over the entire range of expected accelerations and the other over a more limited range, then any of the model atmospheres within the extremes can be determined reasonably well.   Author

N65-17216*# Geophysics Corp. of America, Bedford, Mass.
MASS SPECTROMETER INSTRUMENTATION FOR THE ANALYSIS OF THE MARTIAN ATMOSPHERE   Final Report
R. F. K. Herzog and W. P. Poschenrieder 12 Dec. 1962 87 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950328)
(NASA-CR-60760; GCA-62-17-G) OTS: HC $3.00/MF $0.75

Ion sources, ion-orbits in an inversed magnetron gauge, permanent magnet design, and instruments to prove the basic feasibility of a mass spectrometer to analyze the ion beam generated by an inverted magnetron gauge are discussed. The experiments presented show that a simple mass spectra can be obtained with the new instrument. However, resolution is below the requirements for the Martian probe. Nevertheless, the instrument has important good features—uses very little power; is simple; requires one voltage for ion source operation; and needs no filament.   E.E.B.

N65-17263*# Geophysics Corp. of America, Bedford, Mass.
PLANETARY AERONOMY. IV: THE DUOPLASMATRON AS A VACUUM ULTRAVIOLET LIGHT SOURCE

J. A. R. Samson and H. J. Liebl Washington, NASA, Sep. 1963
20 p refs
(Contract NASw-395)
(NASA-CR-16; GCA-TR-62-8-N) OTS: HC $1.00/MF $0.50

A light source was investigated that would emit radiation below 1000 Å of comparable intensity to the high-voltage pulsed type but which would operate from a dc supply. It was felt that with the combination of hot filament and axial magnetic field as found in the Duoplasmatron that the light intensity would be comparable with the high-voltage pulsed light sources. A preliminary measurement of the total intensity between 1050 and 1350 Å was made using a nitric oxide ion chamber with a Duoplasmatron as an ion source. Spectrums are determined for hydrogen between 1800 and 900 Å and for argon from 550 to 1100 Å.   Author

N65-17264*# Geophysics Corp. of America, Bedford, Mass.
PLANETARY AERONOMY. V: VACUUM ULTRAVIOLET LIGHT SOURCES
J. A. R. Samson Washington, NASA Sep. 1963 59 p refs
(Contract NASw-395)
(NASA-CR-17; GCA-TR-62-9-N) OTS: HC $3.00/MF $0.50

A study is made of photoelectric detectors, since they provide a high degree of accuracy in the measurement of absorption cross sections. As the intensity of radiation is often the important factor in photoionization measurements, the degree of intenseness is defined as strong if, after dispersion by a grating spectrograph, the radiant flux exceeds 10^8 photons/sec at the exit slit. It appears that several light sources exist which produce useful continua from 3500 to 600 A of sufficient intensity to measure (by photoelectric detection techniques) the (a) absorption cross sections of gases and crystals, and (b) reflectance and transmittance of thin films.   Author

N65-17265*# Geophysics Corp. of America, Bedford, Mass.
PLANETARY AERONOMY. I: ABSORPTION AND PHOTOIONIZATION COEFFICIENTS OF PROPYLENE AND BUTENE-1 IN THE VACUUM ULTRAVIOLET
J. A. R. Samson, F. F. Marmo, and K. Watanabe Washington, NASA, Sep. 1963 19 p refs Also published in J. Chem. Phys., v. 36, 1962
(Contract NASw-395)
(NASA-CR-18; GCA-TR-64-4-N) OTS: HC $1.00/MF $0.50

The total absorption coefficient of propylene and butene-1 vapors in the region from 1500 to 2000 Å and the photoionization coefficient in the region 1050 Å to the onset of ionization were measured by photoelectric methods. Pressures ranging from 0.04 to 0.2 mm Hg were used for the total absorption coefficient determination, and three pressures from 0.05 to 2 mm Hg were used for the photoionization absorption coefficient determination. Ionization potentials obtained directly for the two vapors agreed with previously published data.
          Author

N65-17291*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
VENUS-MARS CAPSULE STUDY, VOLUME II
1 Mar. 1963 741 p refs Revised Prepared for JPL
(Contracts NAS7-100; JPL-950250)
(NASA-CR-50811; AD-441924) OTS: HC $10.41/MF $3.50

The equilibrium composition and thermodynamic properties of the Venusian atmosphere have been calculated based on two proposed model compositions. The two model compositions were assumed to contain nine and twenty-five percent CO_2, respectively. The calculations cover the temperature range 200° + 15 000° K and the $\log_{10} \rho/\rho_0$ range of −7.0 to 1.8 at 200° K and 0.4 intervals. An ideal gas mixture in

chemical equilibrium is assumed, including the dissociation and ionization calculations. At the higher temperatures, T > 3000° K, thirty gaseous species have been included in the mixture calculations.   P.V.E.

N65-17404*# Stanford Research Inst., Menlo Park, Calif.
LIGHTNING OBSERVATIONS FROM SATELLITES   Final Report
Arnett S. Dennis Dec. 1964 94 p refs
(Contract NASr-49(18); SRI Proj. 4877)
(NASA-CR-60806) OTS: HC $3.00/MF $0.75
The feasibility of observing lightning from satellites is examined in the light of the effects produced at satellite heights by a lightning flash and of the statistics of lightning occurrences. A sferics detector operating around 600 Mc could be used on a low-orbit satellite at, e.g., 1000 km, but could not be used on a satellite in a stationary orbit (at 37000 km) because of the low signal-to-noise ratio. The short-period variability in flashing rates imposes a lower limit of about 20 flashes per resolution element per observation. This requirement, examined in the light of typical flashing rates and the mechanics of satellite orbits, limits the spatial resolution of the optimum sferics satellite to some 150 km. To realize such resolution without the acceptance of severe limitations upon coverage, it would be necessary to use direction-finding equipment, capable of watching several resolution elements simultaneously. For an elementary system using a fixed antenna, 1000-km resolution would be more appropriate. The potential value of lightning observations from satellites in the fields of meteorology, climatology, atmospheric electricity, geophysics, and radio engineering is examined. It is concluded that such observations would be of some value in radio-noise studies but that their impact upon the other fields would be very slight.   Author

N65-17990# Naval Research Lab., Washington, D. C.
RADIO ASTRONOMICAL OBSERVATIONS OF VENUS WITH HIGH RESOLVING POWER
D. V. Korol'kov, Yu. N. Pariyskiy, G. M. Timofeeva, and S. E. Khaikin [1963] 12 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 149, no. 1, 1963 p 65–67
(NRL-TRANS-936; PB-63-11647; AD-602904) OTS: $0.50
During October–November of 1962 observations were carried out of the radio emission from Venus on 3.02-cm wavelength by means of a large Pulkovo radio telescope with a variable profile antenna. The purpose of these investigations was to evaluate the nature of the distribution of radio brightness, by using high resolving power and high precision of the coordinate measurements with a variable profile antenna. A divergence between the optical and radio methods cannot be explained by the presence of high radiation belts as in the case with the Jupiter. Radio emission is practically absent at a distance of 1.07 R from the center of the disk of the planet; i.e. the height of the radiation region does not exceed 420 km above the cloud cover of Venus. The results of measurements of the effective dimensions of Venus are shown. An attempt to determine the phase variations of radio temperature with displacement of the center of gravity of radio emission led to a negative result. The observations agree best of all with the model over hot surface and cold atmosphere (Extracted).
Author

N65-17995*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE MARTIAN ENVIRONMENT
Robert B. Owen 19 Nov. 1964 42 p refs
(NASA-TM-X-53167) OTS: HC $2.00/MF $0.50

An intensive literature survey was made of the present consensus on the surface and atmospheric conditions of Mars. Knowledge of the gross features of the Martian surface appears to be fairly complete, but there is sharp disagreement on the atmospheric conditions. While estimates of the surface temperature are in fairly close agreement and estimates of the surface pressure range from 10 to 150 millibars, other phenomena such as the blue haze are inexplicable. Formal design criteria for entry vehicles cannot yet be finalized because of the wide range of the environmental parameter values.   Author

N65-18098*# Melpar, Inc., Falls Church, Va.
A DESIGN STUDY PROGRAM OF A POLAROGRAPHIC OXYGEN ANALYZER FOR OBTAINING DATA ON THE ATMOSPHERIC COMPOSITION OF MARS   Final Report, 16 May–15 Sep. 1962
R. T. Foley and G. Halpert [1962] 121 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950284)
(NASA-CR-57085) OTS: HC $4.00/MF $1.00
A laboratory model gas phase polarographic cell was constructed with an 0.5-mil Teflon membrane, a platinum polarized electrode, a silver–silver chloride reference (reversible) electrode, and an aqueous methanol–potassium chloride electrolyte which was designed principally to conduct effectively at lower temperatures. A single compartment cell was constructed to provide a configuration which could be packaged into a compact unit. The cell operated without difficulty when subjected to the atmospheric conditions expected to be encountered during a Mars descent. A breadboard model was designed and constructed including the polarographic cell; the electrolyte injector and the accumulator, which allows the cell to be activated upon arrival at the planet; and the amplifier, which converts current output to a voltage for transmittance.   R.L.K.

N65-18512* National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF SPECTROPHOTOMETRIC OBSERVATIONS OF MARS DURING 1960–1961
Ye. I. Didychenko, I. K. Koval', and A. V. Morozhenko *In its* Bull. of the Main Astron. Obs., Vol. V, Issue 1 Mar. 1965 p 48–69 refs (See N65-18507 08-30) OTS: HC $5.00/MF $1.00
The results are presented of spectrograms of Mars obtained by means of a spectrograph having a linear dispersion of 24 Å/mm in Hγ, set up in the Cassegrain focus of the 70-cm reflector of the Main Astronomical Observatory, Academy of Sciences, Ukrainian S.S.R. From the monochromatic values obtained for the visual albedo of various details of the planet, it was established that (1) the visual albedo of the investigated formulations of Mars (continents, polar caps, Wright clouds) gradually decreases from red to the violet end of the spectrum; and, (2) the polar caps were atmospheric formations during the period of the observations.   Author

N65-18918*# Princeton Univ. Observatory, N. J.
HYDROGEN MOLECULES AND ASTRONOMY: A REVIEW
W. B. Somerville, G. B. Field, and K. Dressler Jan. 1965 90 p refs
(Grant NsG-414)
(NASA-CR-57156) CFSTI: HC $3.00/MF $0.75
Discussed are the following topics: *The Theory of the Hydrogen Molecule*—formulation, nuclear vibration and rotation, the calculation of electronic wave functions, electronic states, the coupling of angular momentum vectors, symmetry, transitions, correction terms to the energy, and the molecular ion

H_2^-; *Hydrogen Molecules in Astrophysics*—general considerations, planetary and stellar atmospheres, and interstellar space; *Spectroscopically Determined Term Values and Transistions in* H_2—the language of molecular spectroscopists, the rotational and vibrational structure of the ground state, and excited states and electronic transitions.   G.G.

N65-18944*# Stanford Univ., Calif. Radioscience Lab.
RESEARCH AT THE STANFORD CENTER FOR RADAR ASTRONOMY Semiannual Report, No. 4, 1 Jul.–31 Dec. 1964
V. R. Eshleman Jan. 1965 11 p refs
(Grant NsG-377)
(NASA-CR-57184) CFSTI: HC $1.00/MF $0.50
    Research covered includes theoretical and experimental radio and radar studies of lunar and planetary ionospheres, atmospheres, and surfaces, and radar studies of the sun and interplanetary medium. Specific projects cover a radar-occultation method for the study of planetary atmospheres, possible models for the atmosphere of Mars, magnetohydrodynamic waves in interplanetary space, a solar radar program, studies of cislunar gas, and data processing.   D.E.W.

N65-18946*# Stanford Univ., Calif. Radioscience Lab.
THE BISTATIC RADAR-OCCULTATION METHOD FOR THE STUDY OF PLANETARY ATMOSPHERES Scientific Report No. 5
G. Fjeldbo and V. R. Eshleman Feb. 1965 34 p refs
(Grant NsG-377)
(NASA-CR-57178; SEL-65-010) CFSTI: HC $2.00/MF $0.50
    Theoretical studies were made of the characteristics of radio waves diffracted at the limb and refracted in the atmosphere of a planet. Sample computations were made of atmospheric perturbations to the communication links to and from a Mars flyby spacecraft having a trajectory that involves occultation of the spacecraft by the planet as seen from the earth. It is concluded that such a radio occultation experiment can provide important new information on the atmospheric scale height and surface density of a planetary atmosphere, and when combined with other information, can help determine atmospheric constituents.   Author

N65-19405# AVCO Corp., Wilmington, Mass.   Research and Advanced Development Div.
LAMINAR AND TURBULENT CONVECTIVE HEATING ON CONICAL BODIES IN PLANETARY ATMOSPHERES
Paul Sones Jan. 1965 38 p refs
(RAD-TM-64-68; AD-454403)
    Methods were devised from existing techniques for the prediction of laminar and turbulent convective heat transfer rates on cones in planetary atmospheres. Comparison of these methods with experimental data from nitrogen–carbon dioxide mixtures was made to check their validity when applied to atmospheres other than air. The laminar predictions are obtained from two methods, a similar solution of the boundary layer equations, and a reference enthalpy approach. The reference enthalpy approach is then further adapted for the turbulent flow conditions. The comparison of theory and experiment shows good agreement and indicates that the methods are valid for planetary atmospheres.   Author

N65-19548# Kitt Peak National Observatory, Tucson, Ariz.
[FACILITIES AND EQUIPMENT FOR ASTRONOMY, PLANETARY AND SPACE SCIENCES] Monthly Report

1964 33 p refs Sponsored by NSF
    Observations and calibration experiments on three telescopes are summarized, as well as progress in Aerobee rocket sounding programs and theoretical consideration of planetary atmospheric compositions from CO_2 absorption data.   E.P.V.

N65-19770*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics
[GROUND-BASED OBSERVATIONS OF VENUS IN THE WAVELENGTH RANGE FROM 0.90 TO 1.40 cm AND BALLOON-BORNE MEASUREMENTS OF MICROWAVE EMISSION FROM MOLECULAR OXYGEN IN THE TERRESTRIAL ATMOSPHERE Final Report, Jun. 1–Dec. 31, 1964
Alan H. Barrett 4 Jan. 1964 5 p refs
(Grant NsG-250-62)
(NASA-CR-57309) CFSTI: HC $1.00/MF $0.50
    Wavelength and brightness measurement values of Venus radio spectra do not agree with those computed previously, which considered nonresonant emission mechanisms involving carbon dioxide and nitrogen as the model. However, the observed values can be approximately matched by including water in the atmospheric model because of the resonant line at 1.35 cm for water. It is also possible that the observations can be fitted with a model which includes microwave scattering with either resonant or nonresonant absorption. The measurement of the $N = 9^+$ line of molecular oxygen during ascent, at float, and during descent is also reported.   E.E.B.

N65-19884*# General Electric Co., Philadelphia, Pa.   Space Sciences Lab.
HYPERVELOCITY HEAT TRANSFER STUDIES IN SIMULATED PLANETARY ATMOSPHERES Final Report
J. S. Gruszczynski and W. R. Warren Mar. 1964 195 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950297)
(NASA-CR-57508) CFSTI: HC $5.00/MF $1.25
    Stagnation point convective heat transfer was measured with a platinum calorimeter and thin-film gages in a simulated planetary atmosphere composed of 9% CO_2 and 91% N_2 over a range of flight velocities up to 45000 ft/sec. It was found that the composition of the CO_2–N_2 mixture does not have a large effect on experimental convective heat-transfer rates. Convective heat-transfer data obtained with gages of different materials indicate that the state of the stagnation point boundary layer can be such that the gage surface effects the observed heat-transfer rates. Stagnation point equilibrium total radiation measurements in 9% CO_2 and 91% N_2, for shock velocities between 22000 and 34000 ft/sec, were compared with the theoretical predictions of Breene, et al. The total radiation behind the incident shock for shock velocities between 20000 and 30000 ft/sec and spectral distributions of equilibrium and nonequilibrium radiation were measured in a 25% CO_2–75% N_2 mixture.   D.E.W.

N65-20758*# Space Technology Labs., Inc., Redondo Beach, Calif. Quantum Physics Lab.
THEORETICAL INVESTIGATION: THE SCATTERING OF LIGHT BY A PLANETARY ATMOSPHERE Final Report, 1 Jun.–1 Dec. 1964
Robert S. Fraser [1964] 125 p refs
(Contract NAS5-3891)
(NASA-CR-57740; STL-4167-6002-RU-000) CFSTI: HC $4.00/MF $1.00
    A theoretical-computational study is presented on how specular reflection at the ground modifies the light scattered

outwards from the top of a homogeneous Rayleigh atmosphere. The computations for this model are compared with computations for a second model, which is the same, except that its ground reflects radiation according to Lambert's law. When their atmospheric optical thickness (τ_1) is not large $(\tau_1 < 1.0)$, the relative difference is small for the flux, increases for the specific intensity, becomes large for the maximum degree of polarization, and is still larger for the neutral point positions. The neutral point characteristics for the two models are quite different for optical thickness smaller than 0.25. The flow of the radiation is divided into several streams that have physical significance and can be calculated separately.
                                                            Author

N65-20799*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
THE ATMOSPHERES OF MARS, VENUS AND JUPITER
J. I. Rasool and Robert Jastrow [1963] 56 p refs Presented at the Symp. on Extraterrestrial Biol. and Org. Chem. at 4th COSPAR Meeting, Warsaw, 3-12 Jun. 1963
(NASA-TM-X-56223) CFSTI: HC $3.00/MF $0.50
     Since composition, temperature, and pressure are the three parameters which determine the structure of a planetary atmosphere, these are discussed by considering the processes by which the planetary atmospheres evolved. The reliable physical data for the planet Mars are summarized. Considerably less is known about Venus. However, the physical constants of the planet and the current hypotheses regarding its structure are given. Also, relatively little is known about the structure of the atmosphere of Jupiter. Being five times farther removed from the sun than the earth, but having a comparable albedo of 0.47, the effective temperature of the planet is only 105° K. The high surface gravity and low temperature together suggest that the gravitational escape of gases from the planet should be extremely inefficient and the chemical composition of the atmosphere should still be primitive, containing large quantities of hydrogen and helium.   E.E.B.

N65-21005*# Consultants and Designers, Inc., Arlington, Va.
ON VENUS MODEL WITH "COLD" ABSORBING ATMOS-PHERE [O MODELI VENERY S "KHOLODNOY" POGLO-SHCHAYUSHCHEY ATMOSFEROY]
A. D. Kuz'min 6 Apr. 1965 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Radiotekhn. (Kiev), v. 7, no. 6, 1964 p 1021-1031
(Contract NAS5-3760)
(NASA-TT-F-9663; ST-LPS-10314) CFSTI: HC $1.00/MF $0.50
     The possibility is considered of interpreting the observed Venus radio emission spectrum in centimeter and millimeter bands by wave absorption in the atmosphere aerosol of the planet. It is shown that the steep slope in the millimeter band of the spectrum may be explained by absorption in trickle-liquid aerosol at ~300° K and containing 0.2 to 0.3 g cm^{-2} of polar liquid with $3.5 \cdot 10^{-12}$ sec relaxation time. Such liquids can be constituted by some functional derivatives of methane CH_4, ethane C_2H_6, benzol C_6H_6, and others. Dust aerosol, consisting of rocks and volcanic formations, does not satisfy the experimental data. It is shown that the atmosphere model, yielding to the observed radiospectrum, must be entirely non-transparent in the infrared and optical bands. Therefore, the surface heating of the planet cannot be the result of direct solar radiation. Surface heating by the planet's inner heat is also considered, and the necessary heat flow is estimated. The possibility of explaining the measured Venus brightness temperature decrease in decimeter band by wave absorption in relatively cold Venus ionosphere (~300° K) is indicated.
                                                            Author

N65-22203*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VENUS, RECENT PHYSICAL DATA FOR
L. D. Kaplan Jun. 1964 6 p refs Submitted for Publication
(NASA-CR-56851) CFSTI: HC $1.00/MF $0.50
     Investigations of the planet Venus during the 1962 inferior conjunction, including the measurements during the flight of Mariner II, are reported. The microwave measurements showed unambiguously that limb darkening was present at 19-mm wavelength; therefore the origin of the high thermal emission at centimeter wavelengths is at, or near, the surface of the planet. After eliminating the limb darkening and dividing the resulting brightness temperature by an assumed surface emissivity derived from earth-based radar measurements of reflectivity, a fairly uniform surface temperature of about 700° K was obtained. Among the other results reported were radius of Venus, 6010±30 km; mass, 4.870×10^{27}g, density, 5.36 g/cc; surface gravity, 900 cm/sec^2; retrograde rotation period, 250±40 days; surface pressure, 10±3 bars; cloud top temperature, 200° K.
                                                            E.E.B

N65-22367*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BLUNT BODY SOLUTIONS FOR SPHERES AND ELLIPS-OIDS IN EQUILIBRIUM GAS MIXTURES
Mamoru Inouye Washington, NASA, May 1965 35 p refs
(NASA-TN-D-2780) CFSTI: HC $2.00/MF $0.50
     An inverse method was used to calculate the flow field in the nose region of blunt bodies traveling at supersonic speeds in equilibrium mixtures of gases that may be present in other atmospheres. Calculations were made for air, nitrogen, carbon dioxide, argon, and a mixture composed of 50% argon, 40% nitrogen, and 10% carbon dioxide. Speeds from 10 000 to 70 000 ft/sec are covered for free-stream densities of 10^{-1}, 10^{-3}, and 10^{-5} times earth sea level values. Correlations are presented for the shock standoff distance, surface pressure distribution, and stagnation-point velocity gradient.   Author

N65-22368*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL STABILITY CHARACTERISTICS OF SEVERAL PROPOSED PLANETARY ENTRY VEHICLES AT MACH 6.73
Peter T. Bernot Washington, NASA, Apr. 1965 24 p refs
(NASA-TN-D-2785) CFSTI: HC $1.00/MF $0.50
     Aerodynamic characteristics of several planetary entry vehicles with different nose-bluntness ratios were obtained over an angle-of-attack range from 0° to 140° at Mach 6.73 and at Reynolds numbers of 0.19×10^6 and 0.25×10^6. At an angle-of-attack of 0°, the flow about these configurations was characterized by large-scale flow separation accompanied by shock-wave fluctuations, notably for the sharp-nose model. As angle of attack was increased about 10°, this separated-flow region on the windward side of the model was swept aside with the result that large increases occurred in normal and axial force and in pitching moment. A high level of positive stability was obtained for all the models at an angle of attack of 0°; for the tests at angles of attack greater than 90°, the models showed no additional stable trim points. Positive stability was maintained for all models near an angle of attack of 0° as center-of-gravity location was varied longitudinally from 20% to 90% of the body length from the nose. Varying the location of the center of gravity along the vertical axis as much as 7.5% of the base diameter resulted in small changes in trim angle of attack. Increasing the nose-bluntness ratio decreased the axial-force coefficient and the stability.   Author

N65-22579*# National Aeronautics and Space Administration, Washington, D. C.
CIRCUMPLANETARY EXPLORATION OF ATMOSPHERES [EXPLORATION CIRCUMPLANETAIRE DES ATMOSPHERES]
F. Link (Acad. of Sci., Prague) 15 May 1962 8 p refs Transl. into ENGLISH from the French paper presented at the COSPAR Symp., Washington, D. C., May 1962
(NASA-TT-F-8219) CFSTI: HC $1.00/MF $0.50

The theory of using a spaceship to make photometric observations of a star during its occultation by Venus or Mars is discussed, and application of this theory for deriving the optical properties of these planetary atmospheres is described. The occultation's photometric curve for each case was computed from the general transmission factor as a function of the luminous ray passing at a minimum altitude, the exponential atmosphere of low density, and the spaceship's position. Numerical examples relative to Mars and Venus are given, and the respective photometrical curves are shown on plots. Adaptation of a simple model of homogenous layer, from the ground to the altitude of 50 km and with the optical density at zenith being 0.03, was used in a study of Mars' dust layer. It was found that the presence of the dust layer modifies the pattern of the occultation considerably. G.G.

N65-22589*# National Aeronautics and Space Administration, Washington, D. C.
POSSIBILITY OF EXISTENCE OF HIGH ELECTRON CONCENTRATIONS IN THE NIGHT ATMOSPHERE OF VENUS [O VOZMOZHNOSTI SUSHCHESTVOVANIYA V NOCHNOY ATMOSFERE VENERY VYSOKIKH ELEKTRONNYKH KONTSENTRATSIY]
A. D. Danilov and S. P. Yatsenko Jun. 1962 6 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 2, no. 2, 1962 p 363–364
(NASA-TT-F-8244) CFSTI: HC $1.00/MF $0.50

The presence of high electron concentrations in the night atmosphere of Venus was investigated in order to explain the high temperatures of the emitting regions that were found by radio observations in the 10-cm wavelength. A model of the Venus ionosphere was constructed on the basis of similar ionization and recombination processes in the terrestrial atmosphere. Comparison with the number of recombinations in the night ionosphere of the Earth led to the assumption that the same ionizing agent acts in the Venus as in the Earth's night atmosphere. The flux of that agent seems to be several times greater in the Venusian atmosphere. G.G.

N65-22739 Army Electronics Research and Development Activity, Fort Huachuca, Ariz.
NUMERICAL SOLUTION OF THE DISTRIBUTION OF WIND AND TURBULENCE IN THE PLANETARY BOUNDARY LAYER
J. F. Appleby and W. D. Ohmstede In Army Dept. Army Sci. Conf. Proc., Vol. I [1964] p 85–99 refs (See N65-22732 12-34)

A planetary boundary layer model is presented which unifies micro- and macroscale measurements in meteorology. The two scales were used to measure different atmospheric phenomena: The logarithmic wind profile equation relates the vertical distribution of wind speed immediately above the earth surface to the momentum transport and roughness characteristics of the surface, while the geostrophic wind equation is used to evaluate the horizontal field of wind in the free atmosphere from knowledge of the pressure distribution. Characteristic of the planetary model is that in the free atmosphere the wind approaches the geostrophic wind, while in the surface boundary layer the wind profile is logarithmic. Study of the model was limited to the barotropic, adiabatic, steady-state case, and requires extension to a broader class of situations. J.M.D.

N65-23299# Space Technology Labs., Inc., Redondo Beach, Calif.
HIGH TEMPERATURE THERMODYNAMIC PROPERTIES OF A 15% CO_2–85% N_2 MIXTURE
J. T. Ohrenberger 5 Mar. 1964 12 p ref
(STL-9990-6631-TU-000)

Thermodynamic properties of a 15% CO_2–85% N_2 (by volume) mixture to 10000° K in the pressure range from 10^{-5} to 10 atm, calculated using a modified equilibrium chemistry program, are presented. The composition chosen simulates a model planetary atmosphere, and the data presented are applicable to entry vehicle radiant heating and communications blackout analyses. Curves presenting the following information are given: (1) the relation between enthalpy and pressure along lines of constant temperature, constant enthalpy, and constant Z (molecular weight of original mixture divided by molecular weight of reacted mixture); (2) the relation between the mole fraction of CN, CO, CO^+, and temperature along lines of constant pressure; and (3) the relation between the electron concentration and temperature along lines of constant pressure. Equations of state, mass fraction conversions, and expressions for finding the number of particles per unit volume are also given. M.P.G.

N65-23799*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
VENUS AND MARS NOMINAL NATURAL ENVIRONMENT FOR ADVANCED MANNED PLANETARY MISSION PROGRAMS
Dallas E. Evans, David E. Pitts, and Gary L. Kraus Washington, NASA, 1965 52 p refs
(NASA-SP-3016) CFSTI: HC $2.00/MF $0.50

A compilation of numerical values for a nominal natural environment for application in studies for advanced manned planetary missions to Venus and Mars is presented. The goal is to provide a standard environment as a base for the various missions and preliminary design studies, and to have a common basis for comparison of end results. G.G.

N65-24307*# RAND Corp., Santa Monica, Calif.
INSTRUMENTATION TO MEASURE MARS' ATMOSPHERIC COMPOSITION, USING A SOFT-LANDED PROBE
R. O. Woods and J. W. Ranftl Apr. 1965 26 p refs
(Contract NASr-21(09))
(NASA-CR-62870; RM-4451-NASA) CFSTI: HC $2.00/MF $0.50

The most suitable method for determining the composition of the Martian atmosphere, using a soft-landed probe, is sought. The methods considered include optical spectroscopy, mass spectrometry, gas chromatography, and other means of gas analysis. Of all the methods investigated, mass spectrometry appears best suited to Martian atmospheric analysis. Not only is the technique intrinsically well suited to the analysis of an unknown mixture of fixed gases, but the output can be telemetered with a minimum of processing. The construction and power requirements of mass spectrometers are readily compatible with spaceborne applications. It is estimated that such an instrument would weigh about 5 to 8 pounds and require 5 to 10 watts of power. Author

N65-24310*# Stanford Univ., Calif. Radioscience Lab.
BISTATIC-RADAR METHODS FOR STUDYING PLANETARY IONOSPHERES AND SURFACES Scientific Report No. 2 (Final)
Gunnar Fjeldbo Apr. 1964 95 p refs
(Grants NsG-377; NSF G-21543)
(NASA-CR-62823; SEL-64-025) CFSTI: HC $3.00/MF $0.75

The transmission of radio waves from the earth to a receiver in a spacecraft that is moving behind a planet makes it possible to observe the variations in the amplitude, phase path, or group path caused by the planetary ionosphere. It is shown that measurement of any one of these quantities may be used to determine the radial electron density distribution in that part of the planetary ionosphere which is probed by the signal. Measurement of two of these quantities simultaneously will reduce uncertainties due to changes in the interplanetary medium or the earth's ionosphere during the experiment. Separate radial electron density distributions can be obtained from the measurements during immersion and emersion and these are related to the spatial properties of the atmosphere on the planet. It is shown that the lower atmosphere as well as the ionosphere of a planet can be studied by using so high a frequency that the signal is not influenced by the ionized component of the atmosphere. Author

N65-24338*# Aeronutronic, Newport Beach, Calif.
DEVELOPMENT OF A HIGH TEMPERATURE BATTERY
W. J. Subcasky, T. M. Place, H. A. Parker-Jones, and W. G. Anderson 20 Apr. 1965 50 p refs
(Contract NAS3-6002)
(NASA-CR-54404; U-4000) CFSTI: HC $2.00/MF $0.50
Experimental cells with sodium anodes and CuCl cathodes were discharged. Membranes used to separate anode and cathode compartments were fabricated from a NaX zeolite or a high sodium porcelain. Cell lives varied from 6 to 22 hours. Tests indicated attack of the membrane by molten alkali metals, which substitution of a magnesium or magnesium alloy anode with a LiCl-KCl anolyte for the sodium eliminated. Cell life was still erratic but in two cases cell lives approaching 70 hours under drain were achieved. Cracking of the zeolite membranes was ascribed to a volume change which occurred when the sodium ions in the zeolite were replaced with lithium ions from the anolyte. Cells constructed with other porous separators and molten CuCl cathodes had lives of the order of 15 hours compared to cells with porous separators and solid CuO cathodes which had lives in excess of 72 hours. Author

N65-24355*# RAND Corp., Santa Monica, Calif.
MARS ENVIRONMENTAL MEASUREMENTS IN SUPPORT OF FUTURE MANNED LANDING EXPEDITIONS
W. H. Krase Apr. 1965 48 p refs
(Contract NASr-21)
(NASA-CR-62872; RM-4437-NASA) CFSTI: HC $2.00/MF $0.50
Measurement techniques to obtain data before manned landing expeditions on Mars are presented for any manned landing: a manned landing using aerodynamic braking from orbit: a manned landing using aerodynamic braking from hyperbolic velocity; and a manned landing using a Mars-orbit-rendezvous flight profile with significant inclination of the rendezvous orbit. A substantially different probe flight profile has to be considered for aerodynamic braking from hyperbolic speed at Mars than that considered for scientific probes. Desirable measurements for unmanned probes in support of future manned landings pertain to atmospheric pressure and temperature; atmospheric density; altitude measurements by a radio altimeter in the lander vehicle; mass spectrometry with heat shield temperature instrumentation and filter radiometry of lander vehicle; surface load bearing capability; surface slope; winds; mapping; radius of Mars; and oblateness of Mars. G.G.

N65-24475# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COSMIC RESEARCH

6 Feb. 1964 245 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, Sep.–Oct. 1963 p 195–334 (FTD-TT-64-42/1+2+4; AD-429870)

CONTENTS:

N65-24480 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SCATTERING OF LIGHT IN A SPHERICAL ATMOSPHERE.
II

I. N. Minin and V. V. Sobolev *In its* Cosmic Res. 6 Feb. 1964 p 61–73 refs (See N65-24475 14-29)

Light scatter study in a planetary atmosphere taking into account the curvature of the atmospheric layer is continued. The case where the absorption coefficient is constant in the atmosphere is examined. An analytic solution of the basic equation determining the value of J is obtained. Light reflection from the surface of the planet is taken into account. Formulas are given for determining the intensity of radiation leaving the atmosphere. The derived solution is applied to the case of the luminosity of a homogeneous sphere. A formula for determining the intensity of radiation leaving a homogeneous sphere after single diffusion is considered in detail. From this are obtained asymptotic formulas for large values of the optical radius of the sphere.   Author

N65-24526 Joint Publications Research Service, Washington, D. C.
THE VENUS MODEL WITH A "COLD" ABSORBING ATMOSPHERE
A. D. Kuz'min *In its* Izv. VUZov: Radiophys., Vol. VII, No. 6, 1964 13 May 1965 p 1–16 refs (See N65-24525 14-07) CFSTI: $7.00

The possibility of interpreting observed radiation spectrum of Venus in the centimeter and millimeter ranges by absorption in the aerosol atmosphere of the planet is analyzed. It is shown that the steep rise in the millimeter region of the spectrum can be explained by absorption in the liquid-mist aerosol at about 300° K and containing 0.2 to 0.3 gm/cm^2 polar liquid with about 3.5×10^{-12} sec relaxation time. Such liquids may be certain functional derivatives of methane, ethane and benzene. The aerosol dust, of mountainous and volcanic origin, has not yielded satisfactory experimental data. It is shown that an atmosphere with the given radiation spectrum must be perfectly opaque in the infrared and visible region. Therefore, direct solar radiation cannot be the source from which the planet surface is heated. Surface heating due to inner heat of the planet is considered and heat flow necessary for this estimated. It is pointed out that the measured decrease in the brightness temperature of Venus in the decimeter range may be possibly explained by absorption in the relatively cold (about 300°K) ionosphere of the planet. The necessary conditions for this electron concentration in the porous ionosphere and the collision frequency in the semitransparent ionosphere are evaluated.   Author

N65-24895*# RAND Corp., Santa Monica, Calif.
USE OF RADIATION GAUGING METHODS TO MEASURE ATMOSPHERIC DENSITY DURING MARTIAN ENTRY
J. W. Ranftl Apr. 1965 81 p refs
(Contract NASr-21)
(NASA-CR-62971; RM-4434-NASA) CFSTI: HC $3.00/MF $0.75

Conclusions made on the basis of this study are these: Except for the remoteness of the location and unknown factors in composition, the Martian atmosphere gaging problem is similar to that of gaging the density of the terrestrial atmosphere from a rapidly moving vehicle. (2) Of techniques available, X-ray backscattering with an electrically generated, continuously operating source of radiation appears most promising for gaging atmospheric density in the range 10^{-8} to 10^{-3} gm/cm^3. This range extends from those densities significant in entry effects (the lesser value) to the estimated near-surface density of Mars (the greater value). Use of an electron beam, generating soft X-rays (bremsstrahlung), is suggested as an auxiliary technique for gaging in the range 10^{-12} to 10^{-8} gm/cm^3, with a possible extension to 10^{-7} gm/cm^3 to overlap the X-ray range.   Author

N65-24908# National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board
UNITED STATES SPACE SCIENCE PROGRAM, REPORT TO COSPAR
1963 290 p refs Presented to the 6th Meeting of COSPAR, Comm. on Space Res., Warsaw, 3 Jun. 1963

N65-24913 National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board
PLANETARY ATMOSPHERES AND METEOROLOGY
In its U.S. Space Sci. Program, Rept. to COSPAR 1963 p 50–71 ref (See N65-24908 14-30)

Distribution and structure of the ionized layers in the earth's atmosphere are described. Research in which the principal phenomena under study are concerned with energetic charged particles, fields and interactions with extraterrestrial influences is presented. Aeronomical investigations are reported, i.e., of temperature, density, neutral and ionic composition, aerosols, the time and space variations of all these, mass motions, and reactions with solar radiation; also meteorological studies defined as those emphasizing the larger-scale dynamical systems involving the interplay of the foregoing parameters through heat exchange, mass transport, over large geographical areas. Results from planets other than the earth are also reported if the data apply unquestionably and exclusively to their atmospheres.   Author

N65-24983*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE JOVIAN ENVIRONMENT

Lawrence M. Trafton 8 Mar. 1962 28 p refs
(Contract NAS7-100)
(NASA-CR-63116; JPL-TM-33-77) CFSTI: HC $2.00/MF
$0.50

Quantitative knowledge of the Jovian atmosphere and the environment above the atmosphere is summarized. Topics covered include composition and structure of the atmosphere, photometric properties of the atmosphere, period of rotation, *magnetic field, and the Jovian radiofrequency spectrum.*
Author

N65-24985*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LOW SUBSONIC DYNAMIC-STABILITY INVESTIGATION OF SEVERAL PLANETARY-ENTRY CONFIGURATIONS IN A VERTICAL WIND TUNNEL, PART I
Jack E. Marte and Robert W. Weaver 1 May 1965 18 p refs
(Contract NAS7-100)
(NASA-CR-63117; JPL-TR-32-743) CFSTI: HC $1.00/MF
$0.50

An experimental investigation of the dynamic-damping parameter, $\bar{C}m_q$, for a series of possible Mars-entry configurations was performed in the Langley 20-ft free-spinning tunnel at low subsonic velocities. Several of the tested configurations exhibited satisfactory dynamic characteristics, including the ability to recover from angular deflections up to 80°. The effect of afterbody shape and maximum angle of oscillation on the dynamic stability of certain configurations was ascertained. Drag and pitching-moment data were also obtained. Author

N65-25246*# Parametrics, Inc., Waltham, Mass.
POTENTIAL PLANETARY ATMOSPHERE SENSORS: THE KRYPTONATE OXYGEN DETECTOR AND THE ALUMINUM OXIDE HYGROMETER Final Report
31 Dec. 1964 88 p refs Prepared for JPL
(Contract NAS7-100; JPL-950684)
(NASA-CR-63139) CFSTI: HC $3.00/MF $0.75

An investigation of the characteristics of a kryptonate oxygen detector and an aluminum oxide hygrometer to be used as planetary atmosphere sensors is presented. Indirect heating of the detector sensor requires less power than resistive heating. The Cu–Kr samples improve the oxygen sensitivity and allow a reduction in operating temperatures. A vacuum tested Cu–kryptonate sample showed no decrease in activity and retained its sensitivity to oxygen. The oxygen sensitivity range was extended by using two sensors operating at different temperatures with separate Geiger tubes monitoring each sensor. The Cu–kryptonate sensitivity to ozone could not be determined. Geiger tubes are operable after sterilization but their electrical characteristics are affected. Sterilization had no effect on hygrometer performance. Water vapor sensitivity was retained after long term vacuum exposure but a slight shift in calibrations was observed. All major hygrometer elements were able to withstand high temperatures and high vacuum. The lucite insulating layer was replaced with SiO. Elements were calibrated to frost points of −100° C and there are indications that their water vapor sensitivity extends to several orders of magnitude below this. R.N.A.

N65-25727# AVCO Corp., Wilmington, Mass. Research and Advanced Development Div.
SHOCK TUBE GAS DYNAMIC CHARTS, PART 2: MARTIAN ATMOSPHERES (MODELS G, H, I, J, AND K)
K. Heron 21 May 1965 124 p refs
(RAD-TM-65-23)

Equilibrium gasdynamic charts suitable for use in conjunction with shock tube experiments are presented for three gas mixtures which are thought to represent the Martian atmosphere. The three mixtures are 65 percent CO_2 + 35 percent A (Atmospheres G&H); 43 percent CO_2 + 32 percent A + 25 percent N_2 (Atmosphere I); 11 percent CO_2 + 13 percent A + 76 percent N_2 (Atmospheres J&K). The charts cover a range of shock velocities (U_s) corresponding to stagnation temperatures greater than 4500° K and stagnation pressures greater than 0.1 atmosphere. Incident, reflected and standing wave, and stagnation point calculations are plotted for each mixture. A simulation plot of the stagnation point conditions in flight and in the shock tube is also presented.
Author

N65-26075*# RAND Corp., Santa Monica, Calif.
NOTE ON THERMAL PROPERTIES OF MARS
C. Leovy Apr. 1965 23 p refs
(Contract NASr-21(07))
(NASA-CR-63278; RM-4551-NASA) CFSTI: HC $1.00/MF
$0.50 CSCL 03B

As measured by Sinton and Strong, the variation of infrared emission from the surface of Mars with local time on Mars is here interpreted in terms of a simplified theory of diurnal temperature variations, in which the effect of the atmosphere is included. The results suggest a very low thermal conductivity for the upper few centimeters of the Martian ground. Such low conductivities appear to be possible only if the material composing these layers is very fine powder having a characteristic size of not more than a few microns. If a linear relationship is assumed between convective heat transfer and surface temperature, the appropriate constant of proportionality is on the order of 10^{-4} cal per cm^2 sec deg.
Author

N65-26255*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME CONSIDERATIONS ON THE USE OF ATMOSPHERIC BRAKING FOR A TRANSFER INTO A MARTIAN ORBIT
Jacob H. Lichtenstein Washington, NASA, Jun. 1965 57 p refs
(NASA-TN-D-2837) CFSTI: HC $2.00/MF $0.50 CSCL 22C

An analytical investigation has been made into utilization of the Martian atmosphere for braking in order to transfer from an approach trajectory into an orbit about Mars. The investigation was restricted to that combination of entry angles and velocities that would permit the vehicle to skip out of the atmosphere in order to establish an orbit about the planet, and the vehicle which was used was a blunt-faced body typical of the Apollo spacecraft. The results show that for a ballistic vehicle the entry corridor is narrow, 3 nautical miles, but with some lift (angle of attack approximately 20°) the corridor widens to about 30 nautical miles. Aerodynamic braking can be utilized to reduce the approach velocity to orbital velocities without exceeding 10 Earth gravitational units and also can be used to change the orbit plane about 10°. In the approach-velocity range of interest, an ablative heat shield for aerodynamic braking was found to require considerably less weight than the rocket fuel for thrust braking.
Author

N65-27226 Joint Publications Research Service, Washington, D. C.
ON THE THEORY OF THE RADIO EMISSION OF VENUS
A. S. Kuz'min *In its* Izv. VUZov: Radiophys., Vol. VIII, No. 1, 1965 24 Jun. 1965 p 1–15 refs (See N65-27225 16–34)
CFSTI: $6.00

We will give the analytical ratios connecting the brightness temperature of the radio emission of a planet surrounded by an absorbent atmosphere with the physical parameters of its surface and atmosphere. For particular cases of the absorption by the entire thickness of the atmosphere and absorption in homogeneous and parabolic layers, numerical solutions have been obtained. The latter are used for an interpretation of the results of radioastronomical measurements of Venus.

Author

N65-27955*# Geophysics Corp. of America, Bedford, Mass. Technology Div.
STUDY OF THE AVERAGE VERTICAL DISTRIBUTION OF TEMPERATURE IN THE MARTIAN ATMOSPHERE Final Report
George Ohring and Joseph F. Mariano Mar. 1965 81 p refs
(Contract NAS9-2423)
(NASA-CR-65049; GCA-TR-65-3-N) CFSTI: HC $3.00/MF $0.75 CSCL 03B

Theoretical computations of the vertical distribution of temperature in the Martian atmosphere are performed with the use of a combined convective-radiative equilibrium model. The model assumes that the Martian troposphere is in convective equilibrium and the Martian stratosphere is in radiative equilibrium. The height of the tropopause is a by-product of the computations. Computations are performed for several physical models of the Martian atmosphere to allow evaluation of the effect of present uncertainties in such parameters as carbon dioxide content, surface pressure, tropospheric lapse-rate, surface temperature, water vapor content, and distribution of absorbing gas with height. On the basis of these calculations, a tentative model of the average vertical distribution of temperature profile is based upon computations with an assumed surface pressure of 25 mb, carbon dioxide amount of 55 m STP, water vapor amount of 10^{-3} prec. cm, adiabatic lapse-rate in the troposphere, and surface temperature of 230° K. It is characterized by a tropopause at a height of about 5 km and an upper stratosphere temperature of about 145° K above 45 km.

Author

N65-28631*# Geophysics Corp. of America, Bedford, Mass.
SOME ASPECTS OF THE ATMOSPHERIC CIRCULATION ON MARS
Wen Tang Washington, NASA, Jul. 1965 45 p refs
(Contract NASw-975)
(NASA-CR-262) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Inferences concerning atmospheric circulation features on Mars are made from analysis and interpretation of some observed Martian cloud systems and from application of meteorological theory to the Martian atmosphere. The trajectories of several cloud systems and the use of two different theoretical criteria suggest the presence of a wave type circulation regime in the mean for the year on Mars. Cloud observations also suggest the presence of sub-tropical high pressure centers, upper level meridional flow at equatorial latitudes, and frontal cloud phenomena at equatorial latitudes. Theoretical estimates of the mean large scale zonal and meridional wind velocities yield values greater than on earth. Theoretical estimates of the maximum surface wind suggest a value greater than 100 m sec^{-1} Computations of the vertical velocity profile, based upon a simplified "ω" equation, indicate greater large scale vertical velocities than on earth, and a "dynamic" tropopause height of about 20 km.

Author

N65-28713# Kitt Peak National Observatory, Tucson, Ariz. Space Div.
STRUCTURE OF THE MARTIAN UPPER ATMOSPHERE
Michael B. Mc Elroy, Jean L'Ecuyer (Yerkes Obs.), and Joseph W. Chamberlain [1963] 32 p refs

We have computed a number of models of the Martian thermosphere with various constants and boundary values in the hydrostatic and heat-flux equations. The investigation is divided into two main parts. First, we have varied the basic parameters, one or two at a time, to find to what extent an uncertainty in one of these fundamental parameters affects the derived exospheric temperature and other characteristics of the upper atmosphere. These models are physically oversimplified, but mathematically serve their purpose. Second, with selected specific chemical compositions, we have integrated the equations with allowance for diffusive separation and absorption of sunlight in different spectral regions. A rather detailed and general discussion is included of the efficiency with which photon energy is converted into the kinetic energy of heat in the neutral atmosphere. The computed models are thought to be fairly representative of an actual atmosphere with the assumed compositions.

Author

N65-28716# National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board.
UNITED STATES SPACE SCIENCE PROGRAM
[1964] 355 p refs Submitted to COSPAR at its 7th Meeting, Florence, Italy, 8 May 1964

A condensed compilation of reports on United States space-science activities is presented which covers the fields of astronomy; solar physics; energetic particles and fields; ionospheric physics; planetary atmospheres and meteorology; planetology; exobiology; the effect of the space environment on man and other terrestrial organisms; celestial mechanics, trajectory studies, geodesy, and gravity; laboratory astrophysics and other supporting studies; communication satellites; international activities; and NASA tracking and data acquisition system—new developments.

E.E.B.

N65-28849*# National Aeronautics and Space Administration, Washington, D. C.
PLANETARY ATMOSPHERES A Continuing Bibliography, Jan. 1962–Feb. 1965
Jun. 1965 144 p refs
(NASA-SP-7017) CFSTI: MF $1.50 CSCL 03B

A selection of annotated references to unclassified reports and journal articles on planetary atmospheres announced in *Technical Publications Announcements* (TPA), *Scientific and Technical Aerospace Reports* (STAR), and in *International Aerospace Abstracts* (IAA) is presented. Each entry in the bibliography consists of a citation and abstract. The majority of the references pertain to studies, measurements and discussions concerning the atmospheres of Mars, Venus and Jupiter, but a limited number of references to the atmospheres of Mercury and Saturn are also included. The scope of coverage was defined to permit inclusion of references to such specific topics as the theory of planetary origins, extraterrestrial environment, planetary exploration and spacecraft reentry, and the physical properties of the planets. All reports and articles cited were introduced into the NASA Information System during the period January, 1962 to February, 1965.

J.L.D.

N65-28960*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PROPULSION ORIENTED STUDY OF MISSION MODES FOR MANNED MARS LANDING
G. R. Woodcock 29 Jun. 1965 39 p refs
(NASA-TM-X-53265) CFSTI: HC $2.00/MF $0.50 CSCL 21F

Results are given of a systems analysis of manned Mars landing missions for a variety of mission modes, including

chemical, nuclear, and electric propulsion, and aerodynamic braking. Consistent ground rules and assumptions were used. The baseline mission requires 450 days for execution and places 4 men on the surface of Mars for 20 days. Advanced missions are discussed. Each mission was analyzed assuming first Saturn V, and then a large reusable Post-Saturn vehicle to be available, in order to provide a comparison. A cost advantage was found for the reusable Post-Saturn for all but very minimal planetary programs. Of the available technologies, the graphite nuclear rocket was found generally preferable to other systems for mission propulsion. Advanced nuclear propulsion, such as ORION, was found to have great potential for advanced missions. **Author**

N65-29299*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYSIS OF THE ERRORS ASSOCIATED WITH THE DETERMINATION OF PLANETARY ATMOSPHERE STRUCTURE FROM MEASURED ACCELERATIONS OF AN ENTRY VEHICLE
Victor L. Peterson Washington, NASA, Jul. 1965 23 p refs
(NASA-TR-R-225) CFSTI: HC $1.00/MF $0.50 CSCL 03B
An analytic method is developed for estimating the errors in the density and pressure structure of a planetary atmosphere constructed from measurements of accelerations experienced by an entry body. Among the sources of error considered both singly and collectively are the measuring accuracy of the accelerometers, the uncertainties in entry speed, entry angle, and aerodynamic coefficients, the frequency of data measurements, and the uncertainty of the attitude of entry bodies having nonzero lift-to-drag ratios. Results of sample calculations are presented to show the accuracy with which the extremes of a range of postulated model atmospheres for Mars can be defined upon measurements of accelerations experienced by a spherically shaped entry body. It is found that if the accelerometer method were used only over that portion of the atmosphere traversed at speeds greater than sonic speed, then any of the atmospheres postulated for Mars can be defined reasonably well even when errors from all sources are combined in the most unfavorable manner. Some of the results obtained by the analytic method are compared with those from more precise numerical calculations and the agreement is found to be excellent. **Author**

N65-29433*# California Univ., Berkeley. Space Sciences Lab.
CONSOLIDATED QUARTERLY PROGRESS REPORT
27 Jul. 1964 65 p Its Ser. 5, Issue 37
(Grants NsG-243-62; NsG-126; NsG-101; NsG-479; NsG-600 et al)
(NASA-CR-59038) CFSTI: HC $3.00/MF $0.75 CSCL 22A
A broad multi-disciplinary program involving the physical, biological, engineering, and social sciences is reported. The studies in the social sciences cover a wide area of problems in management, operations analyses and decision making, the economic impact of the space program, and the international import of the space program. The projects in the physical, biological, and engineering sciences group into areas of space science as follows: *Planetary Atmospheres; Lunar Structure; Fields and Particles; Exobiology; Space Physiology;* and *Engineering Sciences.* Studies on detonation processes associated with various types of fuels and shock waves in gases, propulsion, and reaction kinetics are also included. Further, a project on kilovolt-ion sputtering has a twofold interest with respect to space technology—the degradation of materials in space and ion propulsion. The project combines solid state physics and the physics of plasmas and rarefied gases. **E.E.B.**

N65-29458*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGHLIGHTS OF RECENT SPACE RESEARCH
Robert Jastrow and A. G. W. Cameron [1964] 65 p refs Submitted for Publication
(NASA-TM-X-51903) CFSTI: HC $3.00/MF $0.75 CSCL 03B
Space sciences is the collection of scientific problems to which space vehicles can make some specific contributions not achievable by ground-based experiments. At the present time this field includes broad segments of the traditional disciplines of the earth sciences, physics, and astronomy. In later years the biological sciences will join this group in an important role, as our explorations of the moon and planets provide us with opportunities for studying the conditions under which physical life may have developed. The present article reviews some highlights of recent space research in the physical sciences. **Author**

N65-29475*# California Univ., Berkeley. Space Sciences Lab.
THE EVIDENCE FOR LIFE ON MARS: NATURE AND UNCERTAINTIES
D. G. Rea [1964] 50 p refs
(Grant NsG-101)
(NASA-CR-58430) CFSTI: HC $2.00/MF $0.50 CSCL 03B
A review of the current Martian environment and the question of life on Mars is presented. Some of the physical properties of Mars are tabulated and include mass (0.646×10^{27}g), diameter (6800 km), average density (3.96 g cm^{-3}), and mean distance from the sun (228×10^6 km). Pressure, temperature, and gases present in the atmosphere are among other areas discussed, but it is pointed out that no universal agreement between scientists has been reached. Canals, vegetation, seasonal variations, dust clouds, and radiations are also discussed, with possible explanations relating to life on Mars presented, but again no universal agreement has been reached. **C.T.C.**

N65-29509# National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board.
UNITED STATES SPACE SCIENCE PROGRAM
1965 316 p refs Submitted to the 8th Meeting of COSPAR, Buenos Aires, May 1965

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N65-29722

RESEARCH REPORTS ARE NORMALLY PUBLISHED p 199
17. BIBLIOGRAPHY ON SPACE SCIENCES 152 p (See
N65-29511 18-30)

N65-29722*# Geophysics Corp. of America, Bedford, Mass.
GCA Technology Div.
STUDY OF EARTH'S ATMOSPHERE Final Report
R. Minzner Apr. 1965 98 p refs
(Contract NASw-976)
(NASA-CR-64008; GCA-TR-65-11-N) CFSTI: HC $3.00/MF
$0.75 CSCL 04A
A number of scientific problems relative to studies of the
Earth's atmosphere were investigated and the results are
presented. Included are studies on atmospheric structure
data, planetary atmospheres generated from solar radiation
and absorption considerations, analytical investigation of the
existence of successive isopycnic layers, temperature determi-
nation from diffusion data, and proposed transition model
atmospheres and problems associated with their generation.
Two other studies are included in the appendix: low mesopause
temperatures over the Eglin test range deduced from density
data and temperature determination of planetary atmospheres.
R.N.A.

N65-30247# Hebrew Univ., Jerusalem (Israel). Dept. of Mete-
orology.
**NUMERICAL STUDIES OF PLANETARY CIRCULATIONS
IN A MODEL ATMOSPHERE Final Report**
A. Huss Mar. 1965 159 p refs
(Grant AF-EOAR-63-108)
(AFCRL-65-350)
The evolution of general circulation patterns has been
studied by means of two-level quasi-geostrophic models.
Four different experiments were performed and compared
to an earlier experiment in which the basic initial flow was
assumed to be constant at each pressure level and the Rossby
parameter did not depend on the latitude. The assumptions
made in the different runs were respectively: (1) Maximum
zonal flow at the central latitude. (2) Maximum zonal flow
south of the central latitude. (3) Constant zonal flow at each
pressure level and a latitudinal variation of the Rossby param-
eter. (4) Maximum zonal flow south of the central latitude
and a latitudinal variation of the Rossby parameter. The evolv-
ing distribution of various field-variables was investigated
and compared to the actual distributions observed in the
atmosphere. The most significant results were obtained in
the third run. Specifically only in this case did the asymmetrical
distributions of the field-variables around the central latitude
tend to develop in the direction of the asymmetries observed
in the atmosphere. Author

N65-30357* California Univ., San Diego. Scripps Inst. of
Oceanography.
**POSSIBLE OCEANOGRAPHIC AND RELATED OBSERVA-
TIONS FROM SATELLITES**
John D. Isaacs *In* Woods Hole Oceanog. Inst. Oceanog. from
Space Apr. 1965 p 51 (See N65-30350 19-13) CFSTI: HC
$7.45/MF $2.25
Suggestions are made regarding observations of optical
phenomena, made from satellites, which would yield insight
into meteorological events on the earth and other planets.
Observations of the displacement of the specular image of the
sun in ice clouds appear to be a direct measure of horizontal
acceleration of the cloud and could provide a sounder basis
for the study of planetary atmospheres from earth, earth satel-
lite, and flyby. M.W.R.

N65-30726*# Geophysics Corp. of America, Bedford, Mass.
PLANETARY METEOROLOGY
George Ohring, Wen Tang, and Joseph Mariano Washington,
NASA, Aug. 1965 91 p refs
(Contract NASw-975)
(NASA-CR-280) CFSTI: HC $3.00/MF $0.75 CSCL 03B
Inferences concerning atmospheric circulation features
on Mars are made from analysis and interpretation of some
observed Martian cloud systems and from application of
meteorological theory to the Martian atmosphere. The tra-
jectories of several cloud systems and the use of two dif-
ferent theoretical criteria suggest the presence of a wave
type circulation regime on Mars. Cloud observations also
suggest the presence of subtropical high pressure centers
and upper level meridional flow and frontal phenomena at
equatorial latitudes. Radiative equilibrium temperatures are
computed for the surface and atmosphere of Venus. In the
model used for the computations, it is assumed that the at-
mosphere and cloud cover are both gray in the infrared. The
effect on the computed surface temperature of different values
of infrared emissivity, height, and thickness of the cloud
layer, and infrared opacity of the gaseous absorbers, is
evaluated. Equations are derived for the computation of the
radiative equilibrium temperature profile in the nongray at-
mosphere above the Jovian cloud layer, and circulation
phenomena in the Jovian atmosphere is examined. E.E.B

N65-30733*# National Aeronautics and Space Administration.
Goddard Space Flight Center, Greenbelt, Md.
**A SURVEY OF THE METHODS DEVELOPED FOR THE IN-
VERSION OF THE RADIATIVE TRANSFER PROBLEM FOR
PLANETARY ATMOSPHERES**
Barney J. Conrath Washington, NASA, Aug. 1965 19 p refs
(NASA-TN-D-2940) CFSTI: HC $1.00/MF $0.50 CSCL 04A
Five of the methods developed for obtaining the thermal
profile of a planetary atmosphere from remote radiometric
measurements are discussed and compared. An extension of
the "variable slab" method of King is used in making an inver-
sion calculation for a model atmosphere. The question of the
stability of the solutions of the basic integral equation of the
problem and its implications on the accuracy of the derived
temperature profile are considered. It appears that some
smoothing will have to be introduced, regardless of the method
used, in order to achieve a stable solution from a given set
of observational data containing random errors. A considerable
amount of work remains to be done, including extension of the
variable slab method to arbitrary band transmissions and the
performance of detailed error analyses of the various inversion
methods. It also seems desirable to examine the problem from
the point of view of the uses to be made of the derived thermal
structure in order to ascertain whether the smoothed solutions
retain sufficient physical information to be of value. Author

N65-30746# Air Force Systems Command, Wright-Patterson
AFB, Ohio. Foreign Technology Div.
**CONCERNING THE DETECTION OF WATER IN THE AT-
MOSPHERE OF VENUS**
A. Ye. Salomonovich 7 Apr. 1965 16 p refs Transl. into
ENGLISH from Izv. Vssh. Ucheb. Zaved., Radiofiz. (Gor'kiy),
v. 7, no. 1, 1964 p 51-58
(FTD-TT-65-296/1+2; AD-614770)
The question of the nature of the cloud layer of Venus and
the possibility of detecting water vapor in its atmosphere
is considered in the light of new data concerning the radiation
spectrum of the dark side of the planet. Author

N65-31047*# Geophysics Corp. of America, Bedford, Mass.
PHYSICS OF PLANETARY ATMOSPHERES II: THE FLUO-RESCENCE OF SOLAR IONIZING RADIATION
A. Dalgarno and M. B. Mc Elroy May 1965 25 p refs
(Contract NASw-1283)
(NASA-CR-64424; GCA-TR-65-15-N) CFSTI: HC $1.00/MF $0.50 CSCL 20H
The mid-day dayglow intensities arising from the fluo-rescence of solar ionizing radiation are calculated. The predicted overhead intensities above 120 km of the $O^+(^2P \cdot ^2D)$ lines at $\lambda\lambda 7319-7330\text{Å}$, the Meinel band system of N_2^+, the first negative system of N_2^+, the first negative system of O_2^+, the Hopfield emission system of O_2^+ and the second negative system of O_2^+ are, respectively, 500 R-1 kR, 9 kR, 600 R, 2 kR, 600 R and 400 R. *Author*

N65-31052*# Geophysics Corp. of America, Bedford, Mass.
GCA Technology Div.
PHYSICS OF PLANETARY ATMOSPHERES. I: RAY-LEIGH SCATTERING BY HELIUM
Y. N. Chan (Queen's Univ., Belfast) and A. Dalgarno Apr. 1965
11 p refs
(Contract NASw-1283)
(NASA-CR-64187; GCA-TR-65-14-N) CFSTI: HC $1.00/MF $0.50 CSCL 20H
A variational method is used to calculate the Rayleigh scattering cross sections of helium as a function of wavelength. The value at Lyman-α is 3.53×10^{-26} cm^2. *Author*

N65-31360# Space Technology Labs., Inc., Redondo Beach, Calif.
SELECTIONS FROM THE TRW SPACE TECHNOLOGY LABORATORIES LECTURE SERIES, VOLUME TWO
Thomas L. Branigan, ed. 1965 70 p refs
CONTENTS:
1. THE THEORY AND APPLICATION OF MASERS AND LASERS C. H. Townes (Mass. Inst. of Tech.) p 4-13 (See N65-31361 20-16)
2. THE BIOLOGICAL EXPLORATION OF MARS E. C. Levinthal (Stanford Univ.) p 14-21 ref (See N65-31362 20-23)
3. THE EFFECTS OF HIGH-ALTITUDE EXPLOSIONS W. N. Hess (NASA, Goddard Space Flight Center) p 22-34 refs (See N65-31363 20-29)
4. THE ABUNDANCE OF THE ELEMENTS H. C. Urey (Calif. Univ.) p 35-46 refs (See N65-31364 20-06)
5. THEORETICAL ASPECTS OF THE SPACE RELATIV-ITY-GYROSCOPE EXPERIMENT L. I. Schiff (Stanford Univ.) p 47-50 refs (See N65-31365 20-23)
6. ENERGETIC SOLAR PARTICLES K. A. Anderson (Calif. Univ.) p 51-60 refs (See N65-31366 20-29)
7. THE ORIGIN OF PLANETARY ATMOSPHERES A. G. W. Cameron (NASA, Goddard Inst. for Space Studies) p 61-70 ref (See N65-31367 20-30)

N65-31367 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
THE ORIGIN OF PLANETARY ATMOSPHERES
A. G. W. Cameron 3 Mar. 1964 *In* Space Technol. Labs., Inc. Selections from the TRW Space Technol. Labs. Lecture Ser., Vol. 2 1965 p 61-70 ref (See N65-31360 20-34)
Various processes are considered which might lead to the formation of an atmosphere for most of the planets. Mechanisms for input of gases into an atmosphere, and for loss of gases from an atmosphere are discussed. The structure of the atmospheres of Jupiter, Mars, and Venus is illustrated. Microwave brightness measurements of Venus are interpreted. The atmosphere of the earth is discussed in terms of whether the amount of the rare gases present are derived by outgassing, by capture from the primitive solar nebula, or by some other process. This problem is investigated by examining the isotopic composition of xenon. The composition of xenon extracted from the Murray carbonaceous chondrite is used as a standard to measure the deviations of xenon in other sources. *M.R.W.*

N65-32025*# New Mexico State Univ., University Park. Observatory.
A RAPIDLY MOVING SPOT ON JUPITER'S NORTH TEMPERATE BELT
Elmer J. Reese and Bradford A. Smith Jul. 1965 20 p refs
(Grant NsG-142-61)
(NASA-CR-64568; TN-701-66-9) CFSTI: HC $1.00/MF $0.50 CSCL 03B
A very rapid drift in the longitude of a small dark spot on the south edge of Jupiter's North Temperate Belt (NTBs) was determined from 51 blue and ultraviolet photos. The spot made seven complete circuits of the planet during 268 days of observation between July 1964 and April 1965. Mean daily rotation period of the spot was calculated as $9^h 49^m 18^s.5$. The center of the spot remained stationary near zenographic latitude $+24°$, within the probable error of the measures. This spot was almost completely invisible to the visual observer; it represents the fifth observed outbreak of activity in the North Temperature Current. Rapidly rotating spots in this latitude seem to appear in 12-year intervals. *G.G.*

N65-32082*# Geophysics Corp. of America, Bedford, Mass.
PLANETARY METEOROLOGY Quarterly Progress Report No. 1, 21 Mar.-30 Jun. 1965
20 Jul. 1965 61 p refs
(Contract NASw-1227)
(NASA-CR-64432) CFSTI: HC $3.00/MF $0.75 CSCL 03A
Studies on the meteorology of Mars and Venus are reported. Included are data on the seasonal climatology of Mars, diurnal variation of the surface temperature on Mars, interhemispheric transport of water vapor and the Martian ice caps, comparative studies of zonal wind velocities on Mars and Earth, atmospheric circulation in the Venusian atmosphere, and the composition of the Venusian clouds. *S.C.W.*

N65-32114*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INFRARED INTERFEROMETER SPECTROMETER EXPERIMENT (IRIS). VOLUME I: MARTIAN FLY-BY MISSION
R. A. Hanel and L. Chaney Jul. 1964 56 p refs
(NASA-TM-X-55070; X-650-64-204) CFSTI: HC $3.00/MF $0.50 CSCL 03A
The extraction of significant information on the atmosphere and surface of Mars from thermal emission of the planet is discussed. Also, the design of an infrared interferometer capable of measuring thermal emission spectrum of the planet is described; the requirements and constraints of the infrared interferometer experiment on a planetary fly-by spacecraft are documented. The information will be extracted from the thermal emission spectrum within the interval of 2000 cm^{-1} to 500 cm^{-1}. The experiment is aimed at a wide spectral range to permit clear identification of many predictable spectral features and to allow a search for unexpected phenomena. For a nominal fly-by distance of 5000 km, the resolved area will be a circle of 250-km diameter. *E.E.B.*

N65-32199

N65-32199*# Stanford Univ., Calif. Radioscience Lab.
THE TWO-FREQUENCY, BISTATIC RADAR-OCCULTA-TION METHOD FOR THE STUDY OF PLANETARY IONO-SPHERES Scientific Reports No. 1 and No. 7
G. Fjeldbo, V. R. Eshleman, O. K. Garriott, and F. L. Smith, III
Apr. 1965 33 p refs
(Grants NsG-377; NGR-05-020-065)
(NASA-CR-64460; SEL-65-044) CFSTI: HC $2.00/MF $0.50 CSCL 03B

A method for the study of planetary ionospheres is presented which is based on the use of radio waves propagated between the earth and a spacecraft on an occulting trajectory beyond the planet. Phase path, group path, or amplitude measurements made during spacecraft immersion into, and emersion from, the occulted zone could be used to deduce vertical electron density profiles at the two limb positions probed by the waves. By using two or more harmonically related frequencies, the ionospheric measurements would be self-calibrating, thus avoiding the extreme measurement and computational precision that otherwise would be required. It is suggested that this simple technique would be particularly applicable for the initial exploration of planetary atmospheres. Author

N65-32433* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF EQUILIBRIUM SHOCK-LAYER RADIATION FOR ATMOSPHERIC ENTRY TO MARS
F. Wolf and J. Spiegel *In its* Space Programs Sum. No. 37–33, Vol. IV 30 Jun. 1965 p 99–103 refs (See N65-32410 21-11) CFSTI: HC $7.00/MF $1.75

The gas radiance of mixtures simulating the Martian atmosphere was calculated. The total equilibrium radiation intensity of a 30% carbon dioxide and 70% nitrogen mixture behind the normal shock is given as a function of the free-stream density with flight velocity as a parameter. The total equilibrium radiative energy to the stagnation region was also determined for the same mixture. From the study it appears necessary to compute equilibrium radiation at much lower density than where experimental data exist. The simple procedure of normalizing to free-stream density appears to introduce some problems. At a fixed velocity, density dependence of radiation is acceptable for engineering estimates. The density dependence with velocity is significant. For more exact heat transfer predictions, a simple exponential density dependence should not be used. E.E.B.

N65-32574*# National Aeronautics and Space Administration, Washington, D. C.
SPACE EXPLORATION—WHY AND HOW
Edgar M. Cortwright [1964] 22 p
(NASA-EP-25) CFSTI: HC $1.00/MF $0.50 CSCL 22A

The question "Why explore space when so much of our earth remains unexplored?" is answered in a paper based on an address to the Norwegian Geographical Society. Main Sections deal with the space around the earth, atmospheric circulation and the weather, the earth, and the moon and the planets. Illustrations are included of the Orbiting Geophysical Observatory and schematics of the ionosphere and solar effects on the earth's atmosphere. Also presented are pictures of storms and fronts, the life cycle of a cyclone, and limitations of satellite radar for measuring precipitation. The Tiros, Toss (USWB), and Nimbus meteorological satellites are diagrammed; and pictures of satellite photography are included. The significance of high resolution lunar photography is considered, and lunar photographs taken by Ranger VII are presented. M.W.R.

N65-33556 National Aeronautics and Space Administration, Washington, D. C.
THE ROLE OF REMOTE SENSING IN THE NASA MANNED INTERPLANETARY PROGRAM AND VICE VERSA
Rollin W. Gillespie *In* Mich. Univ. Proc. of the 3d Symp. on Remote Sensing of Environment Feb. 1965 p 79–90 refs (See N65-33550 22-13)

The remote sensing of planetary and interplanetary environments is essential to planning and establishing manned interplanetary capability, while that capability will extend the opportunities for remote sensing. Some engineering features of any possible manned interplanetary program are given as a guide in planning remote sensing experiments. It is urged that terrestrial and planetary applications of remote sensing should be integrated, at once. Author

N65-33835*# IIT Research Inst., Chicago, Ill.
A REVIEW OF RECENT DETERMINATIONS OF THE COMPOSITION AND SURFACE PRESSURE OF THE ATMOSPHERE OF MARS
M. W. P. Cann, W. D. Davies, J. A. Greenspan, and T. C. Owen
Washington, NASA, Sep. 1965 186 p refs
(Contract NAS5-9037)
(NASA-CR-298) CFSTI: HC $5.00/MF $1.25 CSCL 03B

Recent determinations of the Martian surface pressure are reviewed. The polarimetric work of Dollfus is discussed and a new value of the surface pressure, 63 mb, is derived from his data making use of more recent photometric data and of a new treatment of the angular dependence of the planetary surface brightness. A photometric argument by Musman is discussed and the general effects of aerosols and various mixtures of gases on the pressure estimates are investigated. It is shown that these lead to a range of pressures depending on the assumptions made, and that this method of pressure determination leads to indeterminate results. Several spectroscopic works are reviewed and a value of 45 ±25 m-atm for the Martian CO_2 abundance is derived, corresponding to a mean Martian atmospheric temperature of 200° K. Using this abundance, various methods for estimating the surface pressure are reviewed, leading to surface pressures ranging from 13 to 33 mb with relative errors on the order of ±90%. The large uncertainty is due to the fact that the abundance determination rests on the measurement of three weak lines in a single spectrogram. R.N.A.

N65-33919*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy.
ABSENCE OF MARTIAN RADIATION BELTS AND IMPLICATIONS THEREOF
J. A. Van Allen, L. A. Frank, S. M. Krimigis, and H. K. Hills
Aug. 1965 30 p refs *Its* Rept.-65-30
(Grant NsG-233)
(NASA-CR-64870) CFSTI: HC $2.00/MF $0.50 CSCL 03B

A system of sensitive particle detectors on Mariner IV showed the presence of electrons of energy $E_e > 40$ keV out to a radial distance of 165,000 km in the morning fringe of the earth's magnetosphere but failed to detect any such electrons whatever during the close encounter with Mars on July 14–15, 1965, for which the minimum areocentric radial distance was 13,200 km. This result is interpreted to mean that the ratio of the magnetic dipole moment of Mars to that of the earth M_M/M_E is surely less than 0.001 and probably less than 0.0005. The corresponding upper limits on the equatorial magnetic field at the surface of Mars are 200 and 100 gammas, respectively. It appears possible that the solar wind interacts directly with the Martian atmosphere. Author

N65-33962*# Consultants and Designers, Inc., Arlington, Va.
STUDY OF THE ELONGATION OF HORNS OF THE VENUS CRESCENT IN JUNE 1964 [ETUDE DE L'ALLONGEMENT DES CORNES DU CROISSANT DE VENUS EN JUIN 1964]
Audouin Dollfuss and Eric Maurice 21 Jun. 1965 8 p Transl. into ENGLISH from Comp. Rend. Acad. Sci. (Paris), v. 260, Groupe 3, 11 Jan. 1965
(Contract NAS5-3760)
(NASA-TT-F-9685; ST-OA-10343) CFSTI: HC $1.00/MF $0.50 CSCL 03B
  The photometry of the aureole prolonging the horns of Venus at inferior conjunction indicates that the atmosphere above the cloud layer remains charged of particles of approximately 1.5μ in diameter, whose number decreases by a factor of 2 approximately every 2.8 km and whose diffusion coefficient is 3.10^{-8} stilb/phot per centimeter cube contrary to the Sun at the level of the cloud layer. Author

N65-34101# National Academy of Sciences—National Research Council, Washington, D. C. Comm. on Atmospheric Sciences.
THE ATMOSPHERIC SCIENCES, 1961–1971. VOLUME II: SUMMARIES OF PLANNING CONFERENCES
1962 128 p
(PUBL.-946)
  Summaries are presented of the planning conferences on *Atmospheric Physics and Chemistry; Atmospheric Dynamics and Atmospheric Structures and Circulations; Biometeorology; Engineering Applications;* and *New Technologies.* Specific areas of aeronomy, planetary atmospheres, atmospheric composition, cloud physics, climates, water resources, agriculture meteorology, air pollution abatement, and data processing and computing are among the subjects discussed in detail. E.E.B.

N65-34244*# Aerojet-General Corp., Azusa, Calif.
ENGINE OPERATING PROBLEMS IN SPACE: THE SPACE ENVIRONMENT
D. Christensen Washington, NASA, Sep. 1965 227 p refs
(Contract NAS7-98)
(NASA-CR-294) CFSTI: HC $6.00/MF $1.50 CSCL 22A
  This volume presents a comprehensive definition of the space environment as it is presently known. For the purpose of this program, this environment consists of the solar system, excluding the earth and its inner atmosphere. Special emphasis is given to data on electromagnetic and particulate radiation, meteoroid flux, and the structure and composition of the planetary atmospheres. A list of 405 references is included; many of these are annotated. Author

N65-34804# Air Force Cambridge Research Labs., Bedford, Mass.
PROCEEDINGS, 1964 AFCRL SCIENTIFIC BALLOON SYMPOSIUM
Arthur O. Korn, Jr., ed. Jul. 1965 439 p refs *Its* AF Surv. in Geophys. No. 167
(AFCRL-65-486; AD-619695)
  Symposium papers are presented on advances in balloon design, materials, instrumentation, meteorology, and scientific applications. For individual titles see N65-34805–N65-34836.

N65-34830 RAND Corp., Santa Monica, Calif.
THE MARS BALLOON—FEASIBILITY AND DESIGN

M. H. Davis and S. M. Greenfield *In* AFCRL Pocr., 1964 AFCRL Sci. Balloon Symp. Jul. 1965 p 341–351 refs (See N65-34804 23-20)
  The feasibility of Mars balloon operations are discussed. Estimates of the weight and volume requirements for such a balloon system are given. Two balloon types are considered: (1) A balloon to carry instruments from one point on the planet surface to another point nearby for which hydrogen-filled balloons of the equal-pressure type are visualized. (2) A balloon to float at a fairly high altitude for long periods carrying instruments designed to observe the atmosphere and surface for which a ballasted equal-pressure balloon or the superpressure balloon is considered. Air-launched systems are suggested for the Mars balloon. Equations are given for the ratio of balloon mass to total system mass, and the ratio of payload volume to total system volume. Also, parameters of the system are tabulated. No calculations made indicate that the Mars balloon concept is invalid. E.E.B.

N65-34835 Observatoire de Paris (France). Section d'Astrophysique.
DETECTION OF WATER VAPOR IN THE ATMOSPHERES OF VENUS AND MARS
Audouin Dollfus *In* AFCRL Proc., 1964 AFCRL Sci. Balloon Symp. Jul. 1965 p 409–417 refs (See N65-34804 23-20)
  Balloon flights for the detection and measurement of water vapor in the atmosphere of Venus and Mars are discussed. A lightweight sealed cabin, and telescopic and spectroscopic devices used to record the measurements are described. Two lifting devices are mentioned. One type is composed of a cluster of 104 dilatable sounding balloons organized in 34 groups of three balloons, one above the other, along a vertical line 1400 feet long. The second device uses a chaplet-like cluster of 23 neoprene Darex 7000-gram balloons capable of ascents to 80 000 feet. An observation was made from a high mountain site to determine, for calibration purposes, the amount of water vapor contributed by the earth's atmosphere. Reduction of data, including minor corrections and recalibration, yielded the following water vapor values: for Venus, 0.7×10^{-2} g/cm^2, and for Mars, 1.5×10^{-2} g/cm^2. M.R.W.

N65-35792*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EQUILIBRIUM THERMODYNAMIC PROPERTIES OF THREE ENGINEERING MODELS OF THE MARTIAN ATMOSPHERE
Harry E. Bailey Washington, NASA, 1965 164 p refs
(NASA-SP-3021) CFSTI: HC $2.50/MF $1.00 CSCL 20M
  Entropy, enthalpy, pressure, and sound speed of three carbon dioxide–nitrogen mixtures are presented graphically for wide ranges of temperature and density. The temperature range is $250°$ K $\leq$ T $\leq$ 25 000° K (ΔT = 250° K). The density range is $-7.0 \leq \log \rho/\rho_0 \leq +3.0$ ($\Delta\log \rho/\rho_0 = 0.2$). The chemical compositions of the three mixtures correspond to those selected as engineering models of the Mars atmosphere in NASA TN D-2525. Author

N65-35976*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DERIVATION OF PARAMETRIC VALUES FOR A GREENHOUSE MODEL OF THE CYTHEREAN ATMOSPHERE
Robert B. Owen 7 Sep. 1965 77 p refs
(NASA-TM-X-53327) CFSTI: HC $3.00/MF $0.75 CSCL 03A
  Presented is a self-consistent model atmosphere for the planet Venus, with emphasis on parameters of general use in developing vehicle design criteria. Kern and Schilling's program for generation of atmospheric parameter values is coupled with the most recent estimates of surface conditions in order

to derive the atmospheric environment at different altitudes. A range of initial values is used to produce a parametric band most representative of actual conditions. Because of the extreme pressures and temperatures involved, it is felt that design for such an environment presents an engineering problem of the first magnitude.   Author

N65-36000# Harvard Coll. Observatory, Cambridge, Mass. Meteor Dept.
THE STUDY OF METEOR PHENOMENA, UPPER ATMOSPHERE WINDS, AND TURBULENCE AND CHEMILUMINESCENCE IN THE UPPER ATMOSPHERES Final Report
Allan F. Cook, Richard E. Mc Crosky, and Fred L. Whipple
31 Dec. 1964 212 p refs
(Contract AF 19(604)-5196)
(AFCRL-65-33; AD-616732)

CONTENTS:
1. THE STUDY OF METEOR PHENOMENA A. F. Cook, R. E. McCrosky, and F. L. Whipple 25 p refs (See N65-36001 24-30)
2. UPPER ATMOSPHERIC WIND FIELDS FROM METEORIC TRAINS R. F. Hughes and A. F. Cook 117 p refs (See N65-36002 24-13)
3. OPTICAL PROPERTIES OF SATURN'S RINGS, II: TWO-COLOR PHASE CURVES OF THE TWO BRIGHT RINGS F. A. Franklin and A. F. Cook 68 p refs (See N65-36003 24-30)

N65-36391*# Hamilton Standard Div., United Aircraft Corp., Broad Brook, Conn.
MARTIAN ATMOSPHERIC COMPOSITIONAL ANALYSIS: ITS BIOLOGICAL SIGNIFICANCE First Quarterly Progress Report, 15 May–15 Aug. 1965
Dian R. Hitchcock and J. E. Lovelock (Houston Univ.) [1965] 12 p refs
(Contract NASw-871)
(NASA-CR-67354) CFSTI: HC $1.00/MF $0.50 CSCL 03B
The potential biological significance of two types of atmospheric data is critically reviewed. These are the relationship between the atmosphere and surface material, as revealed by an experiment designed to detect a free energy gradient between the two; and observations of the concentrations of selected major and trace components of the atmosphere including isotopic abundances. Discussed are studies relating to life detection by detection of chemical free energy in surface matter; Martian atmospheric compositional analyses; and Martian biological atmospheric experiments.   M.G.J.

1966
STAR ENTRIES

N66-10590# Defence Research Board, Ottawa (Ontario).
DIRECTORATE OF SCIENTIFIC INFORMATION SERVICES.
THE LATITUDE BOUNDARIES OF JUPITER'S BANDS
M. V. Stovas Aug. 1965 8 p refs Transl. into ENGLISH from IGY Inform. Bull., IGY Organizing Comm., Presidium of the Acad. of Sci., Ukrain. SSR, (Kiev), no. 3, 1961 p 65–70
(T-439-R) CFSTI: HC $1.00/MF $0.50

The latitudinal bands of Jupiter are discussed as phenomena reflecting, in Jupiter's atmosphere, the particular tektonics of the planet. Physical relationships are established connecting the latitudes of the bands, the active formations, and the critical parallels—a relationship which can only arise in the solid core of the planet through variation of the potential of deforming forces. The author comes to the conclusion that a volcanism is, perhaps, produced by changes in the rotational regime of the planet.   Author

N66-10609*# Stanford Univ., California. Radioscience Lab.
RESEARCH AT THE STANFORD CENTER FOR RADAR ASTRONOMY Semiannual Report No. 5, 1 Jan.–30 Jun. 1965
V. R. Eshleman Jul. 1965 11 p refs
(Grant NsG-377)
(NASA-CR-67794) CFSTI: HC $1.00/MF $0.50 CSCL 03B
Radar astronomy research is presented on cislunar gas studies, planetary atmospheres and ionospheres, detection of interplanetary shock waves, solar radar studies, and polarization of decametric radiation from Jupiter.   R.N.A.

N66-10684*# Northrop Space Labs., Hawthorne, Calif.
ENGINEERING STUDY TO DETERMINE FEASIBLE METHODS OF SIMULATING PLANETARY ALBEDO AND RADIATION EFFECTS UPON THE THERMAL BALANCE OF SPACECRAFT Final Report
Constantino Cafaro, Merl K. Fairchild, Herbert J. Harris, Arnold P. Shlosinger, and Vincent M. Urban Jan. 1965 168 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950829)
(NASA-CR-67813; NSL-65-5) CFSTI: HC $5.00/MF $1.00 CSCL 20H
This report presents the results of an engineering study and analysis to determine the effects of planetary albedo and radiation from Mars and Venus on the thermal balance of spacecraft orbiting these planets, and to study feasible methods of simulating Mars and Venus planetary albedo and radiation in a space simulation chamber. The existing literature for Mars and Venus provides a multiplicity of planetary albedo values. This study used the range of published albedo values to effectively bound the thermal effects on vehicles orbiting these planets. The results of the thermal analysis indicate that the effects of planetary albedo and radiation are significant. Therefore, the albedo and radiation should be considered in the design and test of spacecraft whose mission includes close orbit of these planets. The extreme variation of environment for Mars and Venus and the conflicting simulation features desired for planetary radiation simulations makes it impractical to devise one simulator system for both Mars and Venus. Simulator design should be tailored to the specific requirements of the spacecraft and its mission.   Author

N66-10836# McGill Univ., Montreal (Quebec). Arctic Meteorology Research Group.
THE BEHAVIOUR OF PLANETARY WAVES IN AN ATMOSPHERIC MODEL BASED ON SPHERICAL HARMONICS Scientific Report No. 1
André Robert Jun. 1965 93 p refs Its Publ. in Meteorol. No. 77
(Contract AF 19(628)-4955)
(AFCRL-65-488; AD-621073)
The grid point method commonly used in numerical calculations presents serious problems in experiments that require a global coverage of the meteorological variables. The shape of the earth and the form taken by the meteorological equations in a system where longitude and latitude are the

basic coordinates, suggest the use of spherical harmonics for the horizontal specification of the variables. This method eliminates grid points and all the truncation errors due. to the finite difference approximations. It also permits the retention of all the terms in the meteorological equations including those that would normally exhibit an anomalous behaviour near the poles. A model based on five levels and 15 coefficients was integrated for 200 days starting from an atmosphere at rest. The integration was then continued for another 20 days with 45 coefficients. Cross-sections show a jet stream in each hemisphere and low level easterlies along the equatorial belt. The amplitudes, the phase speeds and the structure of the planetary waves in the model compare favourably with their atmospheric equivalents. The results of this integration indicate that spherical harmonics could be used profitably in general circulation models and for the preparation of extended range forecasts.   Author (TAB)

N66-10996   Air Force Cambridge Research Labs., Bedford, Mass.
PLANETARY ENVIRONMENTS
Roger A. Van Tassel and John W. Salisbury *In its* Handbook of Geophys. and Space Environment 1965 19 p refs (See N66-10976 02-13)
Brief descriptions and tabulated data are presented on the environments of Mercury, Jupiter, Saturn, Uranus, Neptune, and Pluto. More detailed information is presented for Venus and Mars and includes discussions on their atmospheres, thermal environments, magnetic fields, surface features, satellites, and other tabulated data.   R.N.A.

N66-10998   Air Force Cambridge Research Labs., Bedford, Mass.
RADIO ASTRONOMY
N. H. Dieter, J. P. Castelli, and D. W. Ushakoff *In its* Handbook of Geophys. and Space Environment 1965 15 p refs (See N66-10976 02-13)
Two aspects of radio astronomy, the sources of radiation and the effects produced by the terrestrial atmosphere on the radiation received, are discussed. The discussion begins with fundamental concepts and definitions used in radio astronomy. Atmospheric refraction, scintillation, and absorption effects are examined along with radio emission from the moon, planets, background radiation, discrete sources, and radiation observed in the hydrogen 21-cm line and OH 18-cm line. Included are background radiation maps ranging in frequency from 38 to 960 Mcps, and graphical and tabulated data on the spectra and flux density versus frequency of the discrete radio sources Cassiopeia A, Cygnus A, Taurus A, Virgo A, and Centaurus A.
R.N.A.

N66-11138*# Consultants and Designers, Inc., Arlington, Va.
MEASUREMENTS OF POLARIZATION AND OF BRIGHTNESS TEMPERATURE DISTRIBUTION OF VENUS IN THE 10.6 cm WAVE [IZMERENIYA POLYARIZATSII I RASPREDELENIYA YARKOSTNOY TEMPERATURY VENERY NA VOLNE 10.6 CM]
A. D. Kuz'min and B. Dzh. Klark 14 May 1965 Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Astronomiya, v. 161, no. 3, 1965 p 551–553
(Contract NAS5-3760)
(ST-RA-LPS-10334; NASA-TT-F-9682) CFSTI: HC $1.00/MF $0.50 CSCL 03B
This work is the continuation in a broader fashion of the research conducted in 1962 at CALTECH radioastronomical observatory which consisted in experimental measurements of brightness distribution along Venus' disk in nonpolarized radiation. This pursuit took place near the 1964 lower conjunction and included polarization measurements.   Author

N66-11743*# Consolidated Systems Corp., Monrovia, Calif.
A FEASIBILITY STUDY OF THE MASS SPECTROMETER INSTRUMENTATION FOR THE ANALYSIS OF THE MARTIAN ATMOSPHERE Final Report
W. J. Whistler 7 Sep. 1962 277 p Prepared for JPL
(Contracts NAS7-100; JPL-950327)
(NASA-CR-67959) CFSTI: HC $6.00/MF $1.50 CSCL 14B
The feasibility of a mass spectrometer analysis of the Martian atmosphere was investigated. The mass spectrometer system must yield accurate analytical data in the presence of imposing restrictions on instrument size, weight, power, and magnetic fringe field; sample time and conditions; and transmitting channel capacity. The proposed analyzer is the instrument known as quadrupole mass filter. A general theoretical analysis of the quadrupole analyzer was carried out discussing resolution, transmission efficiency, and power requirements. Theoretical analyses were also performed on the electron bombardment and alpha ion sources; thermal and perfect imaging focal systems; Knudsen flow, getter ion pumping, electrometer detectors, and data handling techniques.   Author

N66-12248*# Geophysics Corp. of America, Bedord, Mass. GCA Technology Div.
EXPERIMENTAL AND THEORETICAL STUDIES IN PLANETARY AERONOMY Final Report
F. F. Marmo Apr. 1965 133 p refs
(Contract NASw-840)
(NASA-CR-68106; GCA-TR-65-16-N) CFSTI: HC $4.00/MF $1.00 CSCL 04A
Detailed technical summaries are presented of published reports generated by investigations of the photochemistry of planetary atmospheres, theoretical studies, experimental studies in the vacuum ultraviolet (VUV) and extreme ultraviolet (EUV) spectral regions, and theoretical aeronomy. The approach employed is discussed, and pertinent tables, figures, and data analyses are included. Brief summaries are also presented on other phases of the continuing research effort to indicate the level of the research, the scope of the work involved, and the scientific direction and approach of future investigations.   M.G.J.

N66-12511# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE FREEWAY FROM OUTER SPACE
A. Shibanov and F. Borisova 24 Jun. 1965 10 p Transl. into ENGLISH from Tekhn. Molodezhi (Moscow), no. 9, 1963 p 3–4
(FTD-TT-65-741/1+2+4; AD-620975)
A popularized account is given of atmospheric factors to be considered in space flight.   TAB

N66-12974*# California Univ., Berkeley. Space Sciences Lab.
THE ATMOSPHERE AND SURFACE OF MARS A Selective Review
D. G. Rea [1965] 67 p refs Presented at the Lunar and Planetary Seminar, Calif. Inst. of Tech., Pasadena, 17 Sep. 1965
(Contract NASr-220; Grant NsG-101)
(NASA-CR-68136) CFSTI: HC $3.00/MF $0.75 CSCL 03B
Recent significant developments in our knowledge and understanding of the Martian atmosphere and surface are reviewed. The surface pressure estimates using different techniques are roughly as follows: near infrared spectroscopy, 3 to 90 mb; ultraviolet albedo and spectrum, 3 to 30 mb. The atmospheric abundances are: CO_2, 45 m atmo; H_2O, 14μ precipitable H_2O, variable in time and space; no others detected. Of the latter two of the most important are O_2 and O_3, whose upper limits are 2 cm atm and 4μ atm respectively. The

atmosphere probably contains a semi-permanent load of sub-micron particles (CO_2 or H_2O crystals, or dust) giving the "blue haze". The blue and white clouds are attributed to ice or CO_2 particles. The surface is characterized by bright and dark areas. The former are covered with dust which is evidently a weathering product of the dark areas. The color is attributed to the ferric ion, but its concentration relative to silicon need not be higher than the relative solar abundance. Dust storms originate in the bright areas, indicating that the local winds at an altitude of 1 meter are higher than 145 km hr^{-1}, and may be as high as 300 km hr^{-1}, or higher. The dark areas consist of maria, oases, and canals. It is suggested that the maria are extensive deposits of volcanic ash, the oases impact craters of small asteroids, and the canals loci of small volcanoes oriented along crustal cracks connecting the oases with themselves and with the volcanoes.   Author

N66-12992*# Southwest Center for Advanced Studies, Dallas, Tex.
MULTIDISCIPLINARY RESEARCH IN SPACE-RELATED SCIENCE AND TECHNOLOGY Semiannual Report
30 Sep. 1965 101 p refs
(Grant NsG-269-62)
(NASA-CR-68362) CFSTI: HC $4.00/MF $0.75 CSCL 04A
    Research activities from April through September, 1965 centered on various studies of planetary atmospheres, iono-spheric and radio physics, particles and fields, and planetology. This summary contains the following topics: History of earth atmosphere; atmospheric and ionospheric structure; plasmas; geomagnetic variations; energetic particles; auroral current systems; planetary atmospheres and interplanetary physics; atmospheric chemistry; infrared studies; lunar investigations; geochemistry; planetary structure; paleomagnetism; kinetic theory; spinors and cosmology; gravitational radiation; various mathematical calculations; and space technology studies.   G.G.

N66-13403*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
VOYAGER DESIGN STUDY. VOLUME IV: SYSTEM DESIGN
15 Oct. 1963 566 p refs
(Contract NASw-696)
(NASA-CR-51839; DOC.-63SD801) CFSTI: HC $8.66/MF $2.75 CSCL 22B
    The following studies are reported: *Entry Lander*—design criteria and limitations, subsystem descriptions, basic trajectories, configuration matrix, etc.; and *Orbiter System Introduction*—configuration selection and sequence of events, configuration design and integration, thermal control, structural and dynamic criteria, and weight analysis. Considered were various systems requirements for entry into the Venus or Mars atmospheres.   G.G.

N66-13407*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
VOYAGER DESIGN STUDY. PART II, VOLUME III: SUBSYSTEM DESIGN
15 Oct. 1963 407 p refs
(Contract NASw-696)
(NASA-CR-51837; Doc.-63SD801) CFSTI: ¡HC $7.07/ MF $2.00 CSCL 22B
    The following studies are reported: *Guidance and Control*—guidance analysis, attitude control, Voyager lander high gain antenna control, and alternatives; *Propulsion*—orbiter propulsion, lander propulsion, and attitude control propulsion; *Power Supply*—system selection and basic studies, recommended and alternate systems, power supply performance, and

mission analysis. Evaluated were the Mars 1969 and 1971 orbiter, the Mars 1973 and 1975 back-up orbiter, the Mars 1975 bus, the Mars 1969 lander, Mars landers after 1969, and Venus landers.   G.G.

N66-13555*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE USE OF CONVENTIONAL WIND TUNNELS TO SIMULATE PLANETARY ATMOSPHERIC AERODYNAMICS
Howard Koester and Norman Fox 15 Nov. 1965 14 p refs
(Contract NAS7-100)
(NASA-CR-68792; JPL-TR-32-762) CFSTI: HC $1.00/MF $0.50 CSCL 01A
    The aerodynamic effects of planetary atmospheric simulation have been experimentally investigated in wind tunnels. Admixtures of carbon dioxide into the conventional dried air working fluid were used to simulate variations of the atmospheric properties. The performance of the wind tunnels, the techniques used, and samples of the data obtained are presented. The results obtained indicate that, within a given range, this approach will yield excellent data for planetary atmosphere entry vehicle design.   Author

N66-13573*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE ROTATION OF THE PLANET MERCURY
Giuseppe Colombo and Irwin I. Shapiro 15 Nov. 1965 27 p refs Revised
(Grant NSG-87-60)
(NASA-CR-68703; SAO Special Rept.-188-R) CFSTI: HC $2.00/ MF $0.50 CSCL 03C
    Reliable radar observations and some of the generally unreliable optical observations of Mercury are shown to be consistent with its rotating in a direct fashion with a period just two-thirds of its orbital period. This possibility may be understood as a consequence of the combined solar torques exerted on tidal deformations and on a permanent asymmetry in Mercury's equatorial plane, as suggested by Colombo. A simple model illustrating this superharmonic resonance phenomenon is developed in some detail; several alternative paths by which Mercury could have reached its present state of motion are discussed briefly.   Author

N66-13681# RAND Corp., Santa Monica, Calif.
COMMENTS ON THE DETECTION OF WATER AND ICE CLOUDS ON VENUS
D. Deirmendjian Oct. 1965 14 p refs Presented at the JPL/CIT Conf. on the Moon and Planets, Pasadena, Calif., 13–18 Sep. 1965
(P-3245; AD-622987) CFSTI: HC $1.00/MF $0.50
    Recent infrared spectroscopic evidence of the existence of ice clouds on Venus is verified by comparison with the spectra of optically dense, terrestrial sunlit cirrus clouds. The uncertainties regarding the total water content of the planetary atmosphere are pointed out, and an experiment is proposed for the detection of possible water droplet clouds, otherwise obscured by the observed ice clouds.   Author (TAB)

N66-14057*# National Aeronautics and Space Administration, Washington, D. C.
VOLCANIC ACTIVITY ON MARS [VULKANICHESKAYA AKTIVNOST' NA MARSE]
G. N. Katterfel'd Jan. 1966 18 p refs Transl. into ENGLISH from Priroda (Moscow), no. 8, 1965 p 103-109
(NASA-TT-F-410) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The Mars opposition occurred in March, 1965—the most favorable time for observing its surface from the earth. Many astronomers pursued a great many studies at this time, which provided new information about Mars. Therefore, the present article has become timely. The author of this article has utilized many data published during the last 55 years, primarily data obtained by Japanese astronomers which are almost unknown to the Soviet reader. Author

N66-14107* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TELESCOPIC DESIGN FOR AN INTERFEROMETRIC SPECTROPHOTOMETER
Ernest Hilsenrath *In its* Goddard Summer Workshop Program [1964] 2 p (See N66-14101 04-14) CFSTI: HC $6.00/MF $1.50
An infrared interferometer spectrometer for the exploration of the earth atmosphere and exploration of other terrestrial-type planets, Mars and Venus, is discussed. The spectrometer is the same for both missions except that the planetary probe instrument will include a telescope. The instrument without the telescope has an acceptance of 8°. Therefore, for a satellite such as Nimbus, the instrument would cover an area about 100 km across at the surface of the earth. However, the 8° acceptance angle is too large for a planetary flyby. The Mars probe is expected to pass about 5000 km from the planet. To cover 250 cm on the planet would require that the acceptance angle of the instrument be reduced to 2.8° and this is the purpose of the telescope. The interferometer spectrometer and the telescope are described and the optics of the system is shown. The obscuration of the telescope is about 12%. E.E.B.

N66-14280# RAND Corp., Santa Monica, Calif.
SOME ASPECTS OF THE CIRCULATION OF MARS
Conway Leovy Nov. 1965 27 p refs Presented at the Conf. on Exploration of the Planets, Blacksburg, Va., 16–20 Aug. 1965
(Contract NASr-21(07))
(NASA-CR-68992) CFSTI: HC $2.00/MF $0.50 CSCL 03B
Estimates of the vertical temperature structure and heat balance of Mars are reviewed and compared with the corresponding quantities on the Earth. The probable resulting circulation is discussed, and reasons for expecting a stronger solstice circulation on Mars than on the Earth are given. The problem of thermally driven tides is reviewed. The amplitude of such tides is likely to be small. Author

N66-14281*# Geophysics Corp. of America, Bedford, Mass. Technology Div.
PHYSICS OF PLANETARY ATMOSPHERES III: THE TIME-DEPENDENT COUPLED HARTREE-FOCK APPROXIMATION
G. A. Victor and A. Dalgarno Aug. 1965 12 p refs
(Contract NASw-1283)
(NASA-CR-68991; GCA-TR-65-24-N) CFSTI: HC $1.00/MF $0.50 CSCL 03B
A coupled Hartree–Fock approximation for describing the effects of time-dependent perturbations on many-electron systems is presented. It is applied to the calculation of the frequency-dependent refractive index of helium gas with results that differ by between 4% and 8% from the accurate values obtained by a refined variational calculation. Author

N66-14331* National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board.
UPPER ATMOSPHERES OF THE PLANETS

Joseph W. Chamberlain (Kitt Peak Natl. Obs.), and Richard M. Goody (Harvard Univ.) *In its* Space Res. Dec. 1965 p 96–107 refs (See N66-14327 05-30) CFSTI: HC $4.00/MF $0.75
A priority system is set up for experiments dealing with planetary upper atmospheres, and a bibliography is included for articles on the subject. Studies serving engineering requirements for support of exploration are considered urgent; programs related to exobiology and the evolution of life are rated important; and research bearing on the origin and evolution of the solar system is classified as desirable. The general area of illuminating the comparative anatomy of atmospheres is considered as academic A recommended program for obtaining data considers topside sounders, airglow measurements, densities from drag data, magnetic fields, special scans of resonance lines, Raman spectra, ultraviolet photometry and absorption from sunlight, far infrared emissions, and occultations. The bibliography lists articles according to (1) general reviews, (2) atmospheric evaporation and evolution, and planetary coronas, (3) composition and photochemistry, (4) structure of upper atmospheres and ionospheres, and (5) airglow and other optical measurements. Some of the references are annotated. M.W.R.

N66-14332* National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board.
ON THE CIRCULATION OF THE ATMOSPHERES OF JUPITER AND SATURN
Raymond Hide (MIT) *In its* Space Res. Dec. 1965 p 107–114 refs (See N66-14327 05-30) CFSTI: HC $4.00/MF $0.75
By concentration on interpretation in terms of hydrodynamical theory of prominent visual features, certain key processes related to the atmospheres of Jupiter and Saturn can be viewed with a minimum of speculation. For Jupiter, it is pointed out, there is the possibility that observations of visual markings in combination with radio astronomical data can lead to information on the internal structure of the planet. Observations made on Jupiter and Saturn are given and theoretical consideration is given to the atmospheric content of these planets. Parameters required to characterize the dynamics of the planetary atmospheres are discussed. The existence of rapid equatorial currents in the fluid layers of both Saturn and Jupiter is mentioned; and apparent variations in equatorial zone of Jupiter from 1908 through 1947 are graphed. Also shown are the longitudinal wanderings of the Great Red Spot between 1831 and 1960; and it is suggested that these variations may be manifestations of a gross torsional hydromagnetic oscillation. M.W.R.

N66-14334* National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board
INTERACTION OF THE SOLAR WIND WITH THE PLANETS
Paul J. Coleman, Jr. (Calif. Univ., Los Angeles) *In its* Space Res. Dec. 1965 p 127–139 refs (See N66-14327 05-30) CFSTI: HC $4.00/MF $0.75
A review is presented of observations of the properties of the interplanetary medium; and the development of theoretical models of the solar wind is summarized. Parameters typical of a quiet solar wind are calculated. Interaction of the solar wind with the Earth's dipolar magnetic field is described, and methods are given for scaling observed effects for interactions with dipolar fields of different moments. Speculations are offered about interaction of solar wind with planetary bodies not shielded by magnetic fields. M.W.R.

N66-14703*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MANNED MARS LANDING MISSION BY MEANS OF HIGH-THRUST ROCKETS

Roger W. Luidens, Richard R. Burley, Joseph D. Eisenberg, Jay M. Kappraff, Brent A. Miller et al Washington, NASA, Jan. 1966 113 p refs
(NASA-TN-D-3181) CFSTI: HC $4.00/MF $0.75 CSCL 22A
An analysis of alternate mission profiles for a manned Mars landing mission in 1980 is presented. Considered were corpuscular radiation shielding, atmospheric entry, structures, solar-flare protection, chemical and nuclear engines, trajectories, and life-support systems. Interactions between the various subsystems were examined to assess the associated weight penalties and to develop those systems that can serve multiple purposes. High-thrust nuclear and chemical propulsion systems were projected for manned landing missions of one to three years in duration, a table contains comparable data of inputs for the presented analysis and those of other analyses.   G.G.

N66-15068*# Southwest Center for Advanced Studies, Dallas, Tex.
MULTIDISCIPLINARY RESEARCH IN SPACE-RELATED SCIENCE AND TECHNOLOGY *Semiannual Report*
30 Sep. 1965 108 p refs Supported in part by AF, Navy and NSF
(Grant NsG-269-62)
(NASA-CR-69137; EPS-65-2) CFSTI: HC $4.00/MF $0.75 CSCL 03B
A summary of studies is presented which were made to develop an understanding of the earth and its atmosphere, and the processes by which it reached its present state. This study also applies to the planets, the moon, and the interplanetary or solar environment in which they are located. Consideration is given to such areas as atmospheric structure, plasmas, geomagnetic variations, energetic particles, auroral current systems, interplanetary physics, infrared studies, and kinetic theory.   C.T.C.

N66-15224*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UTILIZING LARGE PLANETARY PERTURBATIONS FOR THE DESIGN OF DEEP-SPACE, SOLAR-PROBE, AND OUT-OF-ECLIPTIC TRAJECTORIES
M. A. Minovitch 15 Dec. 1965 85 p refs
(Contract NAS7-100)
(NASA-CR-69222; JPL-TR-32-849) CFSTI: HC $3.00/MF $0.75 CSCL 22C
This Report is concerned with three types of free-fall missions that are primarily designed for unmanned vehicles, viz. deep space, solar probe, and out-of-ecliptic missions. The energies required to attain these trajectories are beyond present direct-transfer capability using available boosters. Solar-impact and 90-deg-inclination trajectories require launch energies so high that second-generation nuclear upper stages or ion engines would be absolutely necessary. By utilizing large planetary perturbations, it is possible that a rocket like *Titan II-Centaur* with an extra kick stage can, by sacrificing a few extra pounds for planetary approach guidance, obtain trajectories that a *nuclear Saturn* V cannot obtain.   Author

N66-15338*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSLATIONAL AND ROTATIONAL MOTION OF A BODY ENTERING THE MARS ATMOSPHERE
Peter Hans Feitis 1 Dec. 1965 47 p refs Presented at the Joint Ann. Meeting of the WGLR-DGRR, Berlin, 16 Sep. 1964 Submitted for Publication
(NAS7-100)
(NASA-CR-69252; JPL-TR-32-845) CFSTI: HC $2.00/MF $0.50 CSCL 03B

In the present paper, the density distribution within the Martian atmosphere is derived as a function of altitude and the atmospheric parameters. The equations of motion of simple bodies are established and solved. The case of oblique entry into the atmosphere is also treated. The second part discusses a sphere entering the atmosphere. It is assumed that the center of gravity of the sphere does not coincide with its center. The diameter containing the sphere's center of gravity will be called its "axis." In the third part, the results obtained above are compared with the exact solutions. For the exact solution, a numerical integration of the equations of motion is carried out taking into account all forces neglected above. It is seen that the new theory of motion is a considerable improvement over the old theories.   Author

N66-15400*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ULTRAVIOLET SPECTROSCOPY OF PLANETS
Charles A. Barth 15 Dec. 1965 261 p refs
(Contract NAS7-100)
(NASA-CR-67597; JPL-TR-32-822) CFSTI: HC $5.00/MF $1.00 CSCL 03B
The ultraviolet spectrum of a planet is produced by the following physical processes: (1) dayglow, the scattering of solar photons by atoms and molecules in the upper atmosphere of the planet; (2) daylight, the combination of rayleigh scattering of solar radiation and absorption by atmospheric constituents that produces the planetary albedo in the ultraviolet; and (3) electron excitation, the excitation of atoms and molecules in the upper atmosphere by auroral electrons and by photoelectrons. A quantitative description of each of these processes is given. The atoms and molecules that are prominent in planetary ultraviolet spectra are listed. Calculations are given of planetary molecular emission spectra that are the result of optically thin and optically thick fluorescent scattering and of excitation by auroral bombardment and by photoelectrons. Rocket measurements of the dayglow spectrum of the Earth are given for the spectral region between 2000 and 4000 Å.
          Author

N66-15540*# Space Technology Labs., Inc., Redondo Beach, Calif.
STUDY OF UNMANNED SYSTEMS TO EVALUATE THE MARTIAN ENVIRONMENT. VOLUME III: UNMANNED SPACECRAFT DESIGN
Robert L. Sohn and Paul Dergarabedian 23 Sep. 1965 152 p refs
(Contract NAS2-2478)
(NASA-CR-68742; STL-5303-6015-TU-000) CFSTI: HC $5.00/MF $1.00 CSCL 22B
Description of an unmanned spacecraft designed to evaluate the Martian and Cismartian environments in preparation for subsequent manned Mars landing missions is presented. The design concepts include orbiter/bus (or flyby) systems, entry capsules and survivable landers. In addition, a high resolution photo mapper package is defined. Payloads were selected on the basis of detailed requirements analyses reported in prior phases of the present study contract and the launch capabilities of several boost systems were examined to select the most effective Earth boost system for each of the precursor spacecraft.   M.R.W.

N66-15541*# Space Technology Labs., Inc., Redondo Beach, Calif.
STUDY OF UNMANNED SYSTEMS TO EVALUATE THE MARTIAN ENVIRONMENT. VOLUME II: EXPERIMENTS

Robert L. Sohn and Paul Dergarabedian 23 Sep. 1965 94 p refs
(Contract NAS2-2478)
(NASA-CR-68741. STL-5303-6014-TU-000) CFSTI: HC $3.00/MF $0.75 CSCL 22A

Requirements for experiment programs for the measurement of Martian and Cismartian environmental factors by unmanned precursor missions, based upon the results of a preceding sensitivity analysis, are summarized. Consideration is given to such factors as design feasibility, essential design criteria, system weight, mission operation, and system development. The priorities for the experiments in order of their importance are: solar cosmic radiation environment, meteoroid environment, and atmospheric properties. A list of instruments was prepared, including physical descriptions, to accomplish the required experiments This list is divided into groups according to mission mode requirements (interplanetary, orbiter or capsule/lander), and spacecraft weight capability. It is apparent from the results of the study that the interplanetary environment, particularly solar cosmic radiation and meteoroid flux, are key factors in the design and operation of the manned mission. In contrast, uncertainties in the definition of the Martian atmosphere do not have a dominating impact on the design of the manned system. Techniques for measuring the atmosphere are discussed, and limitations of experiments yielding indirect measurements delineated. M.R.W.

N66-15542*# Space Technology Labs., Inc., Redondo Beach, Calif.
STUDY OF UNMANNED SYSTEMS TO EVALUATE THE MARTIAN ENVIRONMENT. VOLUME IV: SUMMARY
Robert L. Sohn and Paul Dergarabedian 23 Sep. 1965 24 p
(Contract NAS2-2478)
(NASA-CR-68743; STL-5303-6016-TU-000) CFSTI: HC $1.00/MF $0.50 CSCL 22A

A study of the sensitivity of the manned Mars mission to the Martian and Cismartian environment, and a definition of the experiments and unmanned spacecraft to acquire the necessary environment measurements, is reported. The general goals of the study were to: identify those environmental factors that can influence the planning and design of the manned Mars mission; establish the sensitivity of the manned Mars mission system to uncertainty in the Martian and Cismartian environment; define experiments and instrumentation required to make the necessary measurements of the significant environmental factors; and design unmanned systems to evaluate the Martian and Cismartian environment, based on the priorities established from the sensitivity analyses. M.R.W.

N66-15543*# Space Technology Labs., Inc., Redondo Beach, Calif.
STUDY OF UNMANNED SYSTEMS TO EVALUATE THE MARTIAN ENVIRONMENT. VOLUME I: SENSITIVITY ANALYSIS
Robert L. Sohn and Paul Dergarabedian 23 Sep. 1965 300 p refs
(Contract NAS2-2478)
(NASA-CR-68740; STL-5303-6013-TU-000) CFSTI: HC $7.00/MF $1.50 CSCL 22B

Results of a study devoted to establishing the sensitivity of the manned Mars system to uncertainties in the Martian and Cismartian environment are presented. These interactions were established by gathering and analyzing available data on the Martian and interplanetary environments, and placing upper and lower bounds upon the environment data in an effort to establish limits on the uncertainties in each environmental factor. A reference manned mission system design was selected based upon a design study conducted previously, and

utilizing the Mars orbiting rendezvous mode. Weight scaling laws were available for each of the designs so that the interactions of environmental factors on the system design could be readily evaluated in terms of overall gross weight in the earth parking orbit. M.R.W.

N66-15807*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
CRITICAL MEASUREMENTS ON EARLY MISSIONS TO JUPITER
J. M. Witting, M. W. P. Cann, and T. C. Owen Dec. 1965 127 p refs
(Contract NASr-65(06))
(NASA-CR-69561; P-10) CFSTI: HC $4.00/MF $1.00 CSCL 22A

Existing knowledge of Jupiter's magnetosphere, ionosphere, atmosphere, and interior is summarized and critical measurements which can be made from fly-by missions to Jupiter are indicated. Estimates place Jupiter's surface magnetic field strength at about 10 gauss, indicating the presence of radiation belts with 1000 times greater particle densities than those of Earth. The presence of an ionosphere was deduced theoretically, assuming a model atmosphere. Spectral analyses of Jupiter's atmosphere established the presence of hydrogen, methane, and ammonia. Temperature measurements at various wavelengths showed a fluctuation from 125° K to 200° K in the wavelength range 8 μ to 3 cm, indicating that the thermal emission at different wavelengths comes from different depths in the Jovian atmosphere. Model studies of Jupiter's interior indicated the possible presence of metallic hydrogen and a high density core near the center of the planet. Several parameter measurements of the Jovian magnetosphere or atmosphere at future fly-by missions are suggested. G.G.

N66-16151*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE MARINER II MICROWAVE RADIOMETER EXPERIMENT
Douglas Emron Jones 1 Jan. 1966 73 p refs
(Contract NAS7-100)
(NASA-CR-69916; JPL-TR-32-722) CFSTI: HC $3.00/MF $0.75 CSCL 22A

A dual-channel microwave radiometer obtained three scans across the planet Venus at wavelengths of 13.5 and 19 mm. The relationship of the peak temperature values of the three scans supports a hot-surface model for the planet. Several atmosphere–surface configurations were assumed in an attempt to match the limb-darkening ratios and temperature values measured at both wavelengths. The model that agrees best with the data consists of a specular surface and an isothermal cloud-type layer at a temperature near 350° K. The marked difference between the 13.5- and 19-mm temperatures indicates the presence of an abrupt discontinuity in the microwave spectrum of Venus that cannot be due to uncondensed water vapor and hence requires the presence of a molecule or molecules in the atmosphere of Venus that condense or polymerize into liquid form at $T \geq 350°$ K and exhibit line spectra in the vicinity of 13.5 mm and shorter. Author

N66-16207# Hebrew Univ., Jerusalem (Israel). Dept. of Meteorology.
NUMERICAL STUDIES OF PLANETARY CIRCULATIONS IN A MODEL ATMOSPHERE Final Report

Abraham Huss Bedford, Mass., AFCRL, Aug. 1965 127 p refs
(Grant AF-EOAR-64-76)
(AFCRL-65-771; AD-623662) CFSTI: HC $4.00/MF $0.75

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1. NUMERICAL INTEGRATIONS OF A TWO-LEVEL QUASI-GEOSTROPHIC MODEL INCLUDING DIABATIC HEATING AND SURFACE FRICTION A. Huss 59 p refs (See N66-16208 07-13)
2. PRELIMINARY INTEGRATIONS OF A TWO-LEVEL QUASI-GEOSTROPHIC MODEL INCLUDING WATER-VAPOR A. Huss and E. Doron 58 p refs (See N66-16209 07-13)

N66-16208 Hebrew Univ., Jerusalem (Israel). Dept. of Meteorology.
NUMERICAL INTEGRATIONS OF A TWO-LEVEL QUASI-GEOSTROPHIC MODEL INCLUDING DIABATIC HEATING AND SURFACE FRICTION
Abraham Huss *In its* Numerical Studies of Planetary Circulations in a Model Atmosphere Aug. 1965 59 p refs (See N66-16207 07-13) CFSTI: HC $4.00/MF $0.75
The evolution of general circulation patterns has been studied by means of a two-level quasi-geostrophic model including diabatic heating and surface friction. Results are shown for integrations over a period of about 30 days. The Jacobian representing the advection of potential vorticity in the prognostic equations was approximated in two ways: once by the 4-point conventional finite difference analog and once by energy-consistent analog. The distributions of various field-variables were found to resemble the corresponding distributions in the atmosphere, as far as patterns and magnitudes were concerned. Use of the energy-consistent Jacobian resulted in a lower noise level at the conclusion of the run, in higher zonal velocities, in lower energy transformations (except for the $[K' \cdot \tilde{K}]$ transform), and in a more pronounced oscillatory evolution of various field variables. Author

N66-16209 Hebrew Univ., Jerusalem (Israel). Dept. of Meteorology.
PRELIMINARY INTEGRATIONS OF A TWO-LEVEL QUASI-GEOSTROPHIC MODEL INCLUDING WATER-VAPOR
Abraham Huss and Eliyahu Doron *In its* Numerical Studies of Planetary Circulations in a Model Atmosphere Aug. 1965 58 p refs (See N66-16207 07-13) CFSTI: HC $4.00/MF $0.75
Water-vapor was introduced into a two-level quasi-geostrophic model. The local change of the specific humidity was predicted by means of a continuity equation for the water vapor. Changes due to evaporation from the lower boundary (assumed to be an ocean surface) and to precipitation were taken into account. Several integrations were performed with different initial distributions of the specific humidity. In the first series of runs the flow pattern was assumed to develop without being affected by the release of latent heat. In the two last experiments latent heat was introduced into the thermodynamic energy equation. A rapid rise of the noise level was observed in these cases and the integration had to be interrupted after the passage of a few days. Author

N66-16248*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
UNMANNED SYSTEMS TO EVALUATE THE MARTIAN ENVIRONMENT Condensed Summary Report
M. G. Boobar and W. G. Landstrom Sep. 1965 20 p
(Contract NAS2-2477)
(NASA-CR-69997; SID-65-1173) CFSTI: HC $1.00/MF $0.50 CSCL 22A

This report presents a concise description of the study approach, results of manned system environmental sensitivity analyses, and the resulting requirements for unmanned systems designed to acquire the environmental data necessary to support the planning and design of manned Mars missions. Author

N66-16463*# National Biomedical Research Foundation, Silver Spring, Md.
INVESTIGATION OF THERMODYNAMIC MECHANISMS FOR THE PRODUCTION OF COMPOUNDS ESSENTIAL FOR THE ORIGIN OF LIFE First Quarter Technical Report, Oct. 1–Dec. 31, 1965
Margaret O. Dayhoff, Richard V. Eck, and Ellis R. Lippincott [1965] 38 p refs
(Contract NSR-21-003-002)
(NASA-CR-69965) CFSTI: HC $2.00/MF $0.50 CSCL 03B
From present information on the composition, pressures, and temperatures of planetary atmospheres, we have calculated the expected thermodynamic equilibrium composition of the atmospheres of the Earth, Venus, Mars, and Jupiter. Departures from thermodynamic equilibrium must be attributed to special mechanisms, including, on the Earth, biological activity. The major constituents of the terrestrial atmosphere are found to be in approximate thermodynamic equilibrium; while many minor constituents have abundances exceeding their equilibrium values, there is a marked tendency for equilibrium to be restored. It appears that the atmosphere of Venus is in thermodynamic equilibrium, while that of Jupiter is not. The evidence for Mars is less conclusive, although not inconsistent with thermodynamic equilibrium. For none of these planets is there a molecular species with a large predicted equilibrium abundance and spectroscopically accessible absorption features which has not been already identified. The predicted equilibrium abundances of oxides of nitrogen are extremely low on all planets. Author

N66-16597*# Michigan Univ., Ann Arbor.
INVESTIGATION OF GALACTIC AND PLANETARY RADIO ASTRONOMY Third Semiannual Status Report, Jan.–Jun. 1965
Fred T. Haddock Jan. 1966 14 p
(Grant NsG-572)
(NASA-CR-70152) CFSTI: HC $1.00/MF $0.50 CSCL 22A
Progress is reported on studies in galactic and planetary radio astronomy. During this period efforts on the galactic radio astronomy task were almost entirely devoted to the final preparation of the 11.03 rocket payload, culminating with its successful launching. Mechanical problems, the completion of payload and testing, and calibration of the radiometers are discussed. Work performed on the kilometer wave orbiting telescope studies is also presented. Efforts on the planetary radio astronomy task were directed towards photochemical studies of the C-O complex, Martian ionospheric studies, and investigations of topside electron density profiles and forces on non-rigid bodies in space. R.N.A.

N66-16940*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ESTIMATE OF THE CHEMICAL KINETICS BEHIND NORMAL SHOCK WAVES IN MIXTURES OF CARBON DIOXIDE AND NITROGEN FOR CONDITIONS TYPICAL OF MARS ENTRY
Robert L. Mc Kenzie Washington, NASA, Feb. 1966 67 p refs
(NASA-TN-D-3287) CFSTI: HC $3.00/MF $0.75 CSCL 01A

The chemical kinetics behind normal shock waves in mixtures of carbon dioxide and nitrogen are studied. Particular emphasis is placed on a shock speed of 8 km/sec in ambient gas compositions containing 5, 10, and 50 percent CO_2 by volume. These conditions are typical of those anticipated for entry into the Martian atmosphere. Ambient density is varied from 10^{-6} to 10^{-1} times that of the earth sea-level density. The species considered are CO_2, N_2, CO, NO, CN, O_2, C, O_2, C, O, and N. A system of 17 reactions is initially assumed and later reduced to 9 by removing those found insignificant to the gross thermochemical behavior. The methods used for estimating exchange reaction rates are discussed in detail, and a scheme for correlating experimental activation energies is suggested. General features of the nonequilibrium chemistry are presented followed by an analysis of the uncertainties due to possible errors in estimated reaction rates. Particular consideration is given to the kinetics of CN for shock speeds of 4 to 8 km/sec. The CN concentration is shown to rapidly overshoot its equilibrium value for most ambient densities and shock velocities anticipated during entry into the Martian atmosphere. Author

N66-16948# Lockheed Missiles and Space Co., Palo. Alto, Calif. Research Lab.
A MODEL FOR THE LOWER ATMOSPHERE OF MARS BASED ON MARINER IV OCCULTATION DATA
Albert D. Anderson Dec. 1965 34 p refs
(LMSC-6-75-65-62)
The Mariner IV occultation experiment has resulted in low values for the neutral properties (temperature, pressure, and density) and the dominance of CO_2 for the lower atmosphere of Mars. Guided by these new results and theoretical models of the Martian atmosphere, a neutral property model has been derived which takes into account surface air temperature variation. The neutral properties up to 50 km exhibit strong dependence on the surface temperature. An isopycnic (constant density) level is manifested in the model at 10 km where the density value is 5.77×10^{-6} gm cm^{-3} for surface temperatures ranging from 175 to 325° K. At 50 km, the density variation for this same surface temperature range is a factor of four. The height of the tropopause (boundary between convective and radiative equilibrium regimes), taken to vary linearly with the surface temperature, is one of the principal uncertainties since the computed properties are sensitive to it. The accuracy of the model appears to decrease with altitude, especially above 30 km where the effects of CO_2 photochemistry, doppler broadening, and departure from local thermodynamic equilibrium start to become important. Author

N66-17090*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
THE SCIENTIFIC OBJECTIVES OF DEEP SPACE INVESTIGATIONS: SATURN, URANUS, NEPTUNE AND PLUTO
P. J. Dickerman Jan. 1966 54 p refs
(Contract NASr-65(06))
(NASA-CR-70328; P-11) CFSTI: HC $3.00/MF $0.50 CSCL 03B
A study was made of scientific objectives for the four outermost planets: Saturn, Uranus, Neptune, and Pluto. Differences between these planets and planets nearer the sun are shown in a general survey of their structure and composition, and in detailed discussions of the individual bodies. Descriptions of the atmospheres are given, primarily with the aid of spectroscopic and radiometric observations, and better known characteristics are tabulated. Reasons for making probes to these planets are given, and proposed measurements are discussed. These include magnetic field determinations throughout the mission and in the region of the planets; spectrometry and polarimetry of the planetry atmospheres; microwave radiometry and radar probing; charged particle detection in trapped radiation belts; optical occultation experiments for Saturn's ring system and atmospheric studies; rf occultation experiments for atmospheric density determinations; and photography of cloud structure and surface features. C.T.C.

N66-17231*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATIVE EQUILIBRIUM IN PLANETARY ATMOSPHERES. II: AN ANALYSIS AND INTERPRETATION OF SOME VENUS OBSERVATIONS BASED ON A SINGLE REFLECTING CLOUD LAYER MODEL
F. Bartko and R. A. Hanel Sep. 1965 68 p refs
(NASA-TM-X-55392; X-622-65-436) CFSTI: HC $3.00/MF $0.75 CSCL 03B
The equilibrium temperature distribution, thermal emission spectrum, and limb function of a nongrey N_2-CO_2-H_2O model atmosphere have been computed for a large variety of atmospheric parameters which are appropriate for the atmosphere of Venus in the vicinity of the cloud tops. Near infrared absorption by CO_2 of direct and diffusely reflected solar radiation have been included. The important effects of the near infrared solar heating by CO_2 absorption, the water vapor amount, and the cloud top pressure level on the computed results are demonstrated. Other conclusions resulting from a study of the water vapor abundance and thermal emission spectrum depend on the cloud composition. These results are based on the assumption of a single reflecting cloud layer, an assumed CO_2 concentration of 5% and a brightness temperature of 225° K for the cloud tops in the 8–13μ spectral interval. Author

N66-17249*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELIMINARY TRAJECTORY ANALYSIS OF A MARS PROBE
John Mc Nellis Oct. 1965 31 p ref
(NASA-TM-X-55376; X-643-65-390) CFSTI: HC $2.00/MF $0.50 CSCL 22C
This report investigates the feasibility of the needle-nosed probe which is proposed as an experiment on a 1969 Voyager fly-by bus. The probe is to be separated from the bus within 20 days prior to closest approach of the bus. It is to enter the Mars atmosphere and transmit atmospheric entry information back to the bus. Nine bus trajectories were used for generating probe trajectories. For a given bus trajectory a set of probe trajectories (meeting the required constraints) was computed. Each of the trajectories in the set corresponded to a different separation time of the probe prior to closest approach of the bus. For each probe trajectory the separation velocity vector was varied to develop a subset of probe trajectories (with different entry times) for each separation time. It is shown that by choosing the separation time sufficiently early (approximately 20 days prior to closest approach of the bus) the probe mission may be accomplished using a separation velocity under seven meters per second for all acceptable bus trajectories. Author

N66-17290*# Southwest Center for Advanced Studies, Dallas, Tex.
MULTIDISCIPLINARY RESEARCH IN SPACE-RELATED SCIENCE AND TECHNOLOGY Semiannual Report, Period Ending 31 Dec. 1965
31 Dec. 1965 28 p refs
(Grant NsG-269-62)
(NASA-CR-70165) CFSTI: HC $2.00/MF $0.50 CSCL 14B

Research activities during the period October 1965 through December 1965 centered on planetary atmospheres, ionospheric and radio physics, particle and fields investigations, and planetological work. The development of the earth's atmosphere over geological time was traced on the basis of geological evidence and photochemical constraints. Formulation of a hydrodynamic solution to the problem of waves in a warm magnetoplasma was started. Some measurements of plasma capacitance as a function of frequency were made and showed good results. Analysis of ionospheric data obtained at occultation in terms of atmospheric properties established an exceedingly cold Martian atmosphere. Improvements in various test equipments and installations was also reported.

G.G.

N66-17617# Harvard Coll. Observatory, Cambridge, Mass.
HARVARD ASTRONOMICAL OBSERVATORY ANNUAL REPORT, 1965
Donald H. Menzel 1965 16 p
This activity report of the Harvard college astronomical observatory presents a very short review on all research activities during the year 1964 through 1965. Research programs dealing with astrophysical implications of autoionization in atomic spectra, theoretical studies of atomic structures and spectra, radio astronomy projects, solar phenomena and their effects, evolutions of planetary atmospheres, and observations on meteors and comets are very briefly outlined. G.G.

N66-17747 Israel Program for Scientific Translations, Ltd., Jerusalem.
THE SIGNIFICANCE OF ATMOSPHERIC OPTICS IN ASTROPHYSICS [O ZNACHENII ATMOSFERNOI OPTIKI DLYA ASTROFIZIKI]
V. G. Fesenkov *In its* Scattering and Polarization of Light in the Atmosphere 1965 p 4–10 (See N66-17746 08-13)
CFSTI: HC $6.00/MF $1.50
Studies in the field of atmospheric optics which have direct bearings on astrophysics, particularly for the study of the physical nature of the planets and of the planetary medium are discussed. Studies in the following areas are considered: refractive properties of the atmosphere; atmosphere extinction; terrestrial aerosols; physical nature of heat exchange in the surface layer of the atmosphere; determinations of the reflectance of the earth's surface; satellite radiation measurements; influence of radiation on the motion of a continuous medium; and the interaction of earth with high-altitude atmospheric layers and the surrounding interplanetary medium.
M.R.W.

N66-19418# RAND Corp., Santa Monica, Calif.
MULTIPLE SCATTERING IN HOMOGENEOUS PLANE-PARALLEL ATMOSPHERES
T. W. Mullikin Dec. 1965 31 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4846-PR; AD-626205) CFSTI: HC $2.00/MF $0.50
Steady-state multiple-scattering problems for homogeneous plane-parallel atmospheres have been extensively studied by means of the principles of invariance of Ambartsumian and Chandrasekhar. These nonlinear integral equations have been used for computing intensities of radiation on the faces of the atmosphere. Using linear integral-equation theory, it is shown how one computes the source function interior to an atmosphere with optical depth entering the computation only parametrically. Intensities, throughout the atmosphere, are expressed by nonlinear combinations of the computed source function, giving, on the faces, the familiar

scattering and transmission functions. By a reduction developed by Sekera, this analysis is applied to Rayleigh scattering including the effects of polarization. Author (TAB)

N66-19497*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USE OF ENTRY VEHICLE RESPONSES TO DEFINE THE PROPERTIES OF THE MARS ATMOSPHERE
Alvin Seiff and David E. Reese, Jr. [1965] 31 p refs Presented at the Am. Astronautical Soc. Symp. on Unmanned Exploration of the Solar System, Denver, 8–10 Feb. 1965
(NASA-TM-X-56125) CFSTI: HC $2.00/MF $0.50 CSCL 03B
Principles are developed by which the atmospheric properties of an unknown planetary atmosphere can be deduced from responses of a probe vehicle entering the atmosphere. Experiments to determine atmospheric density and pressure as functions of altitude, and to detect and determine quantities of selected gases in the atmosphere are examined in detail. Probe geometries are discussed and take lift, drag coefficient, Mach number, Reynolds number, gas composition, and angle of attack into consideration. The approach to the detection of atmospheric species is by spectrometry of selected wavelengths of emission from the hot atmospheric gases in the shock layer. Laboratory studies and theory show that very bright emission behind the bow wave in atmospheres of nitrogen and carbon dioxide is associated with the cyanogen radical, and detection of the violet band system would constitute direct evidence for nitrogen in the atmosphere. Other radiometers to measure the nitric oxide and argon radiations are discussed. C.T.C.

N66-19525*# National Aeronautics and Space Administration, Washington, D. C.
SIGNIFICANT ACHIEVEMENTS IN PLANETARY ATMOSPHERES 1958–1964
1966 65 p refs
(NASA-SP-98) GPO: HC $0.45; CFSTI: MF $0.75 CSCL 03B
Recent advances resulting from satellite and rocket soundings in the study of the Earth's atmosphere above 30 km, and of Mars', Venus', and Jupiter's atmospheres are discussed. Among the findings reported about the Earth's atmosphere are: an isothermal temperature distribution above 300 km with diurnal and solar activity variations, the role of molecular diffusion in the gravitational field in controlling constituent distributions, the large atmospheric density variations, strong shear zones from 70 to 120 km. Discussed also are hydrogen geocorona, auroral emissions excited by energetic electrons, and micrometeoroid impact rates and densities. An extensive bibliography is included. N.E.N.

N66-19528*# Stanford Univ., Calif. Radio Science Lab.
RESEARCH AT THE STANFORD CENTER FOR RADAR ASTRONOMY Semiannual Status Report No. 6, 1 Jul.–31 Dec. 1965
V. R. Eshleman Jan. 1966 16 p refs
(Grant NsG-377)
(NASA-CR-71090) CFSTI: HC $1.00/MF $0.50 CSCL 03A
Radar and radio studies of lunar and planetary ionospheres, atmospheres, and surfaces, and of the sun and interplanetary mediums were continued. In the cislunar gas studies, the ionospheric electron contents, determined by the Faraday rotation method, were subtracted from each radar determination of total content, and the existence of two distinct regions beyond the ionosphere was reaffirmed. The simultaneous Doppler and Faraday lunar radar data showed that these two methods produce similar conclusions about cislunar magnetospheric wake density. A digital radio polarimeter was used to observe radio noise bursts at 22.2 Mc from Jupiter

and the sun. Jovian emission was felt to confirm the predominance of right hand polarization, and the solar burst analysis showed no chage of either axial ratio or orientation of ellipse from burst to burst. A signal channel coding scheme for additive noise channels with feedback was developed and considered to operate successfully under a sizeable code book. Among the other programs mentioned are planetary surface mapping, planetary atmosphere and ionosphere studies, plasma effects on space probe tracking, and receiver construction techniques.   N.E.N.

N66-19636*# Geophysics Corp. of America, Bedford, Mass. GCA Technology Div.
PHYSICS OF PLANETARY ATMOSPHERES. IV: GAS ANALYSIS BY PHOTOIONIZATION MASS SPECTROMETRY
W. Poschenrieder and P. Warneck   Jan. 1966   34 p   refs
Submitted for Publication
(Contracts NASw-1283; AF 19(628)-3849)
(NASA-CR-71210; GCA-TR-66-1-N;   CFSTI: HC $2.00/MF $0.50 CSCL 03B
    A photoionization mass spectrometer featuring a special 180-degree magnetic analyzer with inclined pole faces is described and its usefulness as a gas analytical tool is explored. The investigated range of ion source pressures was 0 to 150 microns. It was found that pressures up to 20 microns can be utilized for gas analysis. At higher pressures, ion-molecule reactions and increasing light absorption cause nonlinear ion current-pressure relationship. The major advantage of photoionization when compared to electron impact ionization is the simplicity of fragmentation patterns, the major disadvantage, the lower sensitivity. At 20 microns pressure, spark or resonance light sources used in conjunction with a 1/2-meter monochromator produced peak ion intensities around 5×10^{-13} Å. Although these ion intensities are higher than those reported previously, they are still considerably below the ion intensities commonly produced by electron impact ion sources.   Author

N66-19676# Yale Univ., New Haven, Conn.
SEARCH FOR PLANETARY OPTICAL EMISSION, AND STUDY OF FLARE ACTIVITY OF NEARBY STARS   Final Report
Harlan J. Smith   3 Dec. 1965   5 p   refs
(Grant Nonr(G)-00043-62)
(AD-624895) CFSTI: HC $1.00/MF $0.50
    Jovian decameter radio noise storms arise from particles emitting essentially at gyrofrequencies near the Jovian magnetic poles. Parallel microwave radio studies indicate that Jupiter possesses very strong radiation belts. Results suggest that clouds of ions focusing into Jupiter's magnetic poles should also produce strong auroral activity. Detection of such auroras would provide a valuable test of the radio theories, would give information on Jupiter's ionosphere, and would permit a direct mapping of the near-surface magnetic field configurations of the planet. Observational work is reported; however, results have been inconclusive and equipment is required which is much more sophisticated than that available.   E.E.B.

N66-19829   Radio Corp. of America, Princeton, N. J. Radiation Physics Group.
LIFE BEYOND THE ATMOSPHERE—ORIGINS, DETECTION, AND SUPPORT
A. G. Holmes-Siedle   In its Space Electron. [1965] p 7–13 refs   (See N66-19827 10-31)
    This paper discusses the existence and detection of life forms in the universe (with emphasis on our planetary system), and the support of life in manned space travel. It is shown

that while we have several good ideas as to the origin of life, much sophisticated research awaits before we arrive even at a good set of hypotheses of how life occurred. Likewise, while we can detect many forms of life chemically, much more sophisticated sensors are needed for space missions to help decide whether a certain observed phenomenon may constitute "life." Finally, although we have demonstrated short-term life-support outside the atmosphere, the present crude automatic control of a few gases and fluids will have to be refined greatly before we can, for example, establish a colony on the Moon. The advanced electronics for each of these pursuits offers engineers one of the greatest practical challenges of an already challenging technology.   Author

N66-19901*# Arizona Univ., Tucson.   Field Emission and Space Systems Lab.
DETECTION TECHNIQUES FOR TENUOUS PLANETARY ATMOSPHERES   Fifth Six-month Report, 1 Jul.-30 Dec. 1965
Sturat A. Hoenig and Jay Abramowitz   [1966]   211 p   refs
(Grant NsG-458)
(NASA-CR-70934) CFSTI: HC $6.00/MF $1.25 CSCL 07D

CONTENTS:
    1. DETECTION TECHNIQUES FOR TENUOUS PLANETARY ATMOSPHERES   Stuart A. Hoenig and Jay Abramowitz   30 p   refs
    2. CHANGE IN THE THERMIONIC EMISSION CURRENT OF PALLADIUM DUE TO CHEMISORPTION OF ATOMIC AND MOLECULAR HYDROGEN   M. M. Eisenstadt 165 p   refs   (See N66-19902 10-06)

N66-19929#   Tohoku Univ., Sendai (Japan).   Faculty of Science.
SCIENCE REPORTS OF THE TOHOKU UNIVERSITY.   Fifth Series: GEOPHYSICS, VOLUME 16, NUMBER 1
Feb. 1965   51 p   refs
CFSTI: HC $3.00/MF $0.50

CONTENTS:
    1. HEIGHT PROFILES OF DENSITY, COMPOSITION, AND IONIZATION IN THE MARTIAN ATMOSPHERE   H. Kamiyama   p 1–14   refs   (See N66-19930 10-30)
    2. ON A POSSIBLE MECHANISM FOR THE RULES OF POLARIZATION OF pc5 GEOMAGNETIC PULSATIONS   Y. Kato and T. Tamao   p 15–36   refs   (See N66-19931 10-13)
    3. EVALUATION OF CLOUD SEEDING EFFECT BY STATISTICAL ANALYSIS OF SNOWFALL AMOUNT IN THE TOHOKU DISTRICT, JAPAN   S. Yoshida (Sendai District Meteorol. Obs.)   p 37–47   refs   (See N66-19932 10-13)

N66-19930   Tohoku Univ., Sendai (Japan). Geophysical Inst.
HEIGHT PROFILES OF DENSITY, COMPOSITION, AND IONIZATION IN THE MARTIAN ATMOSPHERE
Hiroshi Kamiyama   In its Sci. Rept. of the Tohoku Univ. Feb. 1965   p 1-14   refs   (See N66-19929 10-13) CFSTI: HC $3.00/MF $0.50
    With a particular assumption for the vertical temperature distribution and the chemical composition of the lower atmosphere, a possible model of the Martian atmosphere is deduced on the terrestrial analogy. On the assumption that, at the surface, the pressure is 85 mb and the air is composed

of 2.2% CO_2 and 97.8% N_2, the photodissociation of CO_2 takes place in the region above 128 km, and peaks of the concentration occur at 137 km for O and at 132 km for CO and O_2. Diffusion is considered to be important above 150 km. Two ionospheric layers are formed by the ionization of N_2, O, and O_2, the lower layer being located at about 135 km and the upper at a level between 600 km and 900 km. The maximum electron concentration is about 4×10^4 cm^{-3} in the lower layer and between 9×10^4 and 1.8×10^5 cm^{-3} in the upper layer. The height variation of the ion composition is also described.
Author

N66-20077*# TRW Systems, Redondo Beach, Calif.
THEORETICAL INVESTIGATION: THE SCATTERING OF LIGHT BY A PLANETARY ATMOSPHERE Interim Report, 22 Sep.–22 Dec. 1965
Robert S. Fraser [1965] 26 p refs
(Contract NAS5-9678)
(NASA-CR-70943; TRW-4520-6001-RO-000) CFSTI: HC $2.00/MF $0.50 CSCL 03B
A theoretical study of the characteristics of radiation scattering in a planetary atmosphere was conducted. It is shown that the lower boundary of the atmosphere reflects radiation specularly according to Fresnel's law. The following investigations are reported: (1) the accuracy of the computed x and y functions of Chandrasekhar; (2) the albedo of diffuse sky light from both smooth and rough water surfaces; and (3) the characteristics of the neutral points which refer to the directions where the degree of polarization of light from the atmosphere vanishes.
D.T.

N66-20080*# Litton Systems, Inc., St. Paul, Minn. Applied Science Div.
DESIGN AND DEVELOPMENT OF AN AIR-EJECTOR POWERED PNEUMATIC SURFACE SAMPLING SYSTEM
L. W. Rees and M. J. Grundtner Dec. 1965 97 p refs Prepared for JPL Its Rept.-2930
(Contracts NAS7-100; JPL-950771) CFSTI: HC $3.00/MF $0.75 CSCL 13G
A pneumatic surface sampling system for use under simulated Martian environmental conditions was designed, fabricated and tested. The unit relies upon the phenomena of air blast dislodgment of surface particles by an external, traversing sampler head, pneumatic transport of particulate material to the main sampler body, and subsequent centrifugal separation by a cyclone collector. It is capable of operation with particles as large as 800 microns diameter at ambient pressures as low as 5 millibars and at ambient temperatures down to $-60°C$. In tests with sandy soils the collection rate of this device is on the order of 15 grams per minute for periods up to 10 minutes. Biological assessment has shown the acquired samples are representative of the environment.
Author

N66-20124# RAND Corp., Santa Monica, Calif.
ON THE SCATTERING OF SUNLIGHT INTO PLANETARY SHADOW CONES
R. C. Moore and G. F. Schilling Dec. 1965 27 p refs Presented at the Symp. on Interdisciplinary Aspects of Radiative Energy Transfer, Philadelphia, 24–26 Feb. 1966
(P-3282; AD-625260) CFSTI: HC $2.00/MF $0.50
Refraction and multiple scattering of solar radiation in a planetary atmosphere cause the propagation of appreciable amounts of radiative energy into the planet's geometric shadow cone. The implications of this atmospheric phenomenon to research in various fields are discussed. Examples are studies of lunar eclipses, the presence of the Venus ring near inferior conjunction, the astronomical problem of the appearance of the

earth as a planet, and the flights of spacecraft in earth orbit and in cislunar space. It is shown that the results of such studies can provide data in disciplines involving geophysics, planetary atmospheres, solar physics, astronomy, and astronautics. Rigorous solutions of radiative transfer problems in a real atmosphere, however, still are beyond the capabilities of present theory. Some preliminary quantitative results in the visible range of the electromagnetic spectrum have been obtained through the use of a semiempirical method. This technique promises to become a useful tool in the fields of study discussed.
Author (TAB)

N66-20131*# California Univ., Berkeley. Space Sciences Lab.
BIOCHEMICAL ACTIVITIES OF TERRESTRIAL MICROORGANISMS IN SIMULATED PLANETARY ENVIRONMENTS Final Report
[1964] 14 p refs
(Grant NsG-126-61)
(NASA-CR-71195) CFSTI: HC $1.00/MF $0.50 CSCL 06C
The major effort of this research program was directed toward environmental conditions that might serve as constraints upon the evolution or development of microorganisms on the surface of anaerobic planets such as Mars. Studies on low temperature freezing and thawing of microorganisms, on alternatives for atmospheric oxygen, and on ultraviolet radiation as an environmental constraint are discussed. R.N.A.

N66-21229*# National Biomedical Research Foundation, Silver Spring, Md.
THERMODYNAMIC EQUILIBRIA IN PLANETARY ATMOSPHERES
Ellis R. Lippincott (Md. Univ.), Richard V. Eck, Margaret O. Dayhoff, and Carl Sagan (Harvard Univ.) [1965] 38 p refs Prepared in cooperation with Md. Univ. and Harvard Univ.
(Grant NGR-21-003-002)
(NASA-CR-69829) CFSTI: HC $2.00/MF $0.50 CSCL 20M
From present information on the composition, pressures, and temperatures of planetary atmospheres, the expected thermodynamic equilibrium composition of the atmospheres of the Earth, Venus, Mars, and Jupiter is calculated. Departures from thermodynamic equilibrium must be attributed to special mechanisms, including, on the Earth, biological activity. The major constituents of the terrestrial atmosphere are found to be in approximate thermodynamic equilibrium; while many minor constituents have abundances exceeding their equilibrium values, there is a marked tendency for equilibrium to be restored. It appears that the atmosphere of Venus is in thermodynamic equilibrium, while that of Jupiter is not. The evidence for Mars is less conclusive, although not inconsistent with thermodynamic equilibrium. For none of these planets is there a molecular species with a large predicted equilibrium abundance and spectroscopically accessible absorption features which has not been already identified. The predicted equilibrium abundances of oxides of nitrogen are extremely low on all planets. The measured upper limits on the abundances of Cytherean CH_4, NH_3, and CO are all inconsistent with the possibility of elemental carbon or organic molecules in contact with the atmosphere of Venus either on the surface or as clouds. The possibility of small quantities of oxygen on Mars is not excluded. It is suggested that the colored materials at the Jovian clouds are organic molecules, produced by non-equilibrium processes in a reducing environment.
Author

N66-21667 International Business Machines Corp., San Jose, Calif. Research Lab.
EQUATIONS OF MOTION FOR ELASTIC BODIES EN-TERING A PLANETARY ATMOSPHERE
P. K. C. Wang and N. E. Langlois *In its* Papers on the Control of Distributed Parameter Aeroelastic Systems Nov. 1965 p 5-28 refs (See N66-21666 11-01) CFSTI: HC $5.00/MF $1.00

The equations governing the motion of elastic bodies during their entry into a planetary atmosphere at hypersonic velocities were derived under reasonable physical assumptions. The results are applied to the derivation of a mathematical model for a simplified flexible aerodyanmic re-entry vehicle. Author

N66-21767*# Geophysics Corp. of America, Bedford, Mass. GCA Technology Div.
CONTRIBUTIONS TO PLANETARY METEOROLOGY Final Report
George Ohring, Wen Tang, Frederick B. House, and Joseph Mariano Mar. 1966 87 p refs
(Contract NASw-1227)
(NASA-CR-71627; GCA-TR-66-8-N) CFSTI: HC $3.00/MF $0.75 CSCL 03B

Reports are given on meteorological investigations of Mars and Venus. The steady state, axially symmetric case of the general circulation of the Martian atmosphere was considered. It was concluded that the symmetrical regime cannot remain stable. A simple theoretical model was formulated to investigate the Martian latitudinal and seasonal variation of the surface and mean atmospheric temperatures, and the atmospheric heat transport effect on the temperature climate is discussed. The water vapor mixing ratios near the cloudtops of Venus were studied, assuming a water vapor mixing ratio which decreases with altitude at rates comparable to those in the earth's upper troposphere. It was concluded that some of the observed amounts of water vapor are compatible with the presence of aqueous clouds. A diffusion model was developed to study the interhemispheric water vapor transport and the Martian ice caps. It is suggested that this transport requires a large scale eddy diffusion coefficient, and that this size coefficient leads to meridional speeds of water vapor isopleths that are in good agreement with the observed speed of darkening wave propagation. N.E.N.

N66-22218*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
THE GREENHOUSE EFFECT IN A GRAY PLANETARY ATMOSPHERE
Rupert Wildt 3 Jun. 1965 16 p refs Submitted for Publication
(NASA-TM-X-56621) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Hopf's analytical solution is illustrated for several values of the greenhouse parameter, i.e., the ratio of gray absorption coefficients for insolating and escaping radiation, assumed to be constant at all depths. Author

N66-22239*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVED ULTRAVIOLET REFLECTIVITY OF MARS
Dennis C. Evans [1965] 18 p refs Submitted for Publication
(NASA-TM-X-56654) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Ultraviolet spectrograms of Mars (2400-3500 Angstroms, ~50 Angstrom resolution) have been obtained using an ob-jective grating spectrograph on an Aerobee rocket. The data indicate a reflectivity of 0.04 to 0.08 in the ultraviolet, increasing toward shorter wavelength according to a Rayleigh Law. The data can be represented by an $N_2:CO_2:A$ model atmosphere with a surface pressure of about 5 to 20 millibars. The photographic appearance of the planet in the blue is interpreted as a loss of surface contrast and reflectivity rather than by absorption in the atmosphere by the "blue haze". The model predicts the general appearance of the planet in the photographic ultraviolet, blue, visible, and red. There are serious biological implications since the model predicts that ultraviolet radiation (2000-3000 Angstroms) will reach the surface. Author

N66-22465# Aeronutronic, Newport Beach, Calif.
ABSORPTION BY CO_2 BETWEEN 8000 AND 10,000 cm^{-1} (1-1.25 MICRON REGION)
Darrell E. Burch, David A. Gryvnak, and Richard R. Patty 6 Aug. 1965 37 p refs
(Contract Nonr-3560(00); ARPA Order 273)
(U-3200; AD-626316) CFSTI: HC $2.00/MF $0.50

The absorption by CO_2 in the 9300 to 9650/cm region and 8000 to 8325/cm region were studied. Spectra were obtained for four samples of CO_2 in the 1.0 micron region at a pressure of 2.5 atmospheres and path lengths up to 933 meters. Spectra were obtained for ten samples of CO_2 in the 1.2 micron region at pressures as high as 15 atmospheres for path lengths up to 32.9 meters and pressures as high as 2.50 atmospheres for path lengths up to 933 meters. The strengths of the important bands and the half-widths of several lines have been measured. Tables of transmittance versus wavenumber are included for both regions as well as photographs of most of the specrra. Also presented are tables of the integrated absorptance versus wavelength for both regions. Author (TAB)

N66-23025*# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 130
18 Apr. 1966 76 p refs Transl. into ENGLISH from Russian
(JPRS-35095; TT-66-11147-130) CFSTI: $3.00

Abstracts are presented for Sino-Soviet-bloc research studies dealing with astronomy, meteorology, oceanography, terrestrial geophysics, and the upper atmosphere and space. Also included are news articles and several reports of scientific conferences. M.W.R.

N66-23052 Texas Univ., Austin. Dept. of Astronomy.
THE ATMOSPHERIC ENVIRONMENTS OF MARS AND VENUS
G. de Vaucouleurs *In* Southwest Res. Inst. Bioastronautics and the Exploration of Space Dec. 1965 p 59-76 refs (See N66-23048 12-04) CFSTI: HC $9.40/MF $2.50

Current knowledge of the Mars and Venus atmospheres is summarized. This incorporates discussions of the atmospheric pressure, violet layer, structure and temperature, and clouds and winds. C.T.C.

N66-23493*# Stanford Univ., Calif. Radioscience Lab.
MODELS FOR THE ATMOSPHERE OF MARS BASED ON THE MARINER IV OCCULTATION EXPERIMENT Scientific Report Nos. 2 and 15
Gunnar Fjeldbo, Wencke C. Fjeldbo, and Von R. Eshleman Jan. 1966 36 p refs
(Contract NGR-05-020-065; Grant NsG-377)
(NASA-CR-74152; SEL-66-007) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Several possible atmospheric models are investigated based on data from the radio occultation experiment, and one is shown to be more likely than the others. Profiles in height of the constituent number densities, electron number density, temperature, pressure, and mass density are derived. The analysis indicates that Mars has a tenuous carbon dioxide lower atmosphere with a temperature of about 180°K near the surface, and an atomic oxygen upper atmosphere with a temperature of only about 80°K. Frozen carbon dioxide particles may be an almost permanent feature of the atmosphere at intermediate altitudes. The main daytime ionospheric layer has its peak density at 120 km, and is most likely a Bradbury (F2) layer with the principal ion (O^+) being lost through $O^+ + CO_2 \rightarrow O_2^+ + CO$. The atmospheric mass density decreases nearly ten orders of magnitude from the surface to the base of the exosphere at 140 km, thus remaining several orders of magnitude below the density of the earth's atmosphere at corresponding altitudes despite the lower gravity.   Author

N66-23536*# National Aeronautics and Space Administration Washington, D. C.
STUDY OF THE EARTH-TYPE PLANETS [IZUCHENIYE PLANET TIPA ZEMLI]
I. K. Koval Mar. 1966 13 p Transl. into ENGLISH from Zemlya i Vselennaya (USSR), vol. 1, no. 6, 1965 p 53–55
(NASA-TT-F-9898) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The article discusses work by the USSR Academy of Sciences Commission on Planetary Physics in 1964 and 1965. Atmospheric pressure investigations by photometric and polarimetric means were conducted. Aerosol influence is considered. Values for the Mars and Venus atmospheres are presented. Various individual studies were presented by their authors.   Author

N66-23538*# National Aeronautics and Space Administration, Washington, D. C.
BRIGHTNESS DISTRIBUTION IN THE LIMB ZONE OF MARS [RASPREDELENIYE YARKOSTI V KRAYEVOY ZONE MARSA]
L. A. Bugayenko, O. I. Bugayenko, I. K. Koval', and A. V. Morozhenko Mar. 1966 11 p refs Transl. into ENGLISH from Fiz. Luny i Planet (Kiev), 1964 p 54–57
(NASA-TT-F-10018) CFSTI: HC $1.00/MF $0.50 CSCL 03A

The results of photoelectric observations of Mars by the method of cross sections are presented. The observations were made in the Cassegrain focus of the 70 cm reflector at the Main Astronomical Observatory of the Academy of Sciences of the Ukrainian SSR. In the opposite of 1963, the brightness distribution along the apparent radius of the planet was traced up to r=0.97R δ. The data, averaged and corrected for turbulent scintillation of the image and for the finite size of the diaphragm (D=0''.35), are tabulated. It was found that for $\lambda < 390$ nm the atmosphere of Mars possesses an appreciable true absorption, while for longer wavelengths scattering provides the main contribution.   Author

N66-23610*# National Aeronautics and Space Administration, Washington, D. C.
INTENSITY OF METHANE ABSORPTION IN 6190 Å BAND ON JUPITER'S DISK [OB INTENSIVNOSTI METANOVOGO POGLOSHCHENIYA V POLOSE CH₄ 6190 Å NA DISKE YUPITERA]
V. G. Teyfel' and N. V. Priboyeva Apr. 1966 28 p refs Transl. into ENGLISH from Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat. Nauk (Alma-Ata), v. 16, no. 1, 1963 p 61–73
(NASA-TT-F-10062) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Measurements were made of the 6190 Å absorption band intensity in the spectra of the equatorial zone and two temperate zones of Jupiter in 1959–61. The observations were made in order to detect the possible variations in the intensity of the band as a function of time and the position of the investigated zone on Jupiter's disk. It was established that the width of the 6190 Å band was the same for all of the investigated zones of Jupiter. There is an indication of small variations in the band intensity from one night to another. These variations are not associated with solar activity or with the longitude of the central meridian of the planet. The possible reasons for these variations are as follows: the change in the thickness of the pure gas layer which is over the cloud layer and photochemical processes in the atmosphere of Jupiter. The first reason seems more likely.   Author

N66-23674*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A COMPARISON OF TWO GREENHOUSE MODELS FOR THE CYTHEREAN ATMOSPHERE
Robert B. Owen 4 Dec. 1963 24 p refs
(NASA-TM-X-57375; MTP-AERO-63-82) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Surface temperatures of Venus appear to be comparable to a red-hot oven on the basis of a comparison of two Greenhouse models for the Cytherean atmosphere which are described in the literature. Temperature estimates as high as 750°K and surface pressures of over 30 atm are estimated. Temperature of the dark pole has been established by Drake to be 540°K; and possible polar seas may contain liquid benzene, acetic acid, butyric acid, and phenol. If the pressure exceeds 60 atm, the seas may contain a bit of liquid water. It is concluded that if the described model is valid, a surface landing presents very complex engineering problems.   M.W.R.

N66-23682*# Geophysics Corp. of America, Bedford, Mass.
TEMPERATURE DETERMINATION OF PLANETARY ATMOSPHERES
Raymond A. Minzner, Bernard O. Sauermann, and Lennart R. Peterson Jun. 1964 46 p refs
(Contract NASw-976)
(NASA-CR-71862; GCA-TR-64-9-N) CFSTI: HC $2.00/MF $0.50 CSCL 03B

A method is presented whereby accurate temperature-altitude profiles of planetary atmospheres may be determined from the number-density profiles of two inert gases having markedly different molecular weights M. In the earth's atmosphere, such gases would preferably be helium and argon. In contrast to previous methods in which mass-density profiles permitted the calculation of only the ratio T/M at altitudes sufficiently below the highest altitude of density data, the two-gas method yields values of kinetic temperature T, not only at low altitudes where number-density data for both gases exist, but also up to the greatest altitude for which the light-gas number-density data have been measured. The method depends upon recently developed mass spectrometers with detection sensitivities of the order of 10^5 particles per cubic centimeter. A rigorous error analysis predicts the accuracy of the resulting temperatures on the basis of sensor and telemeter characteristics, and allows for optimizing any actual experiment as far as range and number of measurements are concerned.   Author

N66-23713*# Michigan Univ., Ann Arbor. Radio Astronomy Observatory.
INVESTIGATION OF GALACTIC AND PLANETARY RADIO ASTRONOMY Status Report, Jul.-Dec. 1965

Fred T. Haddock   Mar. 1966   10 p   refs
(Grant NsG-572)
(NASA-CR-74173)   CFSTI: HC $1.00/MF $0.50   CSCL 03A

A preliminary report is presented which discusses a sounding rocket flight to measure cosmic radiation intensity on three frequencies, 0.75, 1.225, and 2.0 Mc/s. No data was received at 0.75 Mc/s because of a lack of sensitivity; however, preliminary analysis of data at 1.225 and 2.0 Mc/s seems to confirm a sharp fall in the spectrum. A discussion of some points in connection with the 0.75 Mc/s measurement is provided. Studies were also conducted of the Martian atmosphere and ionosphere. A model constructed from data derived from the Mariner IV flight, was extended to include detailed photoionization and heat balance factors. Some conclusions regarding the atmosphere above the subsolar region are given.
                                                            H.S.W.

N66-23776*# Lowell Observatory, Flagstaff, Ariz.
THE ATMOSPHERIC PRESSURE AT THE SURFACE OF MARS
Karl D. Rakos   [1965]   15 p   refs   *Its* Bull. No. 131, Vol. VI, No. 12
(Grant NGR-03-003-003)
(NASA-CR-71312)   CFSTI: HC $1.00/MF $0.50   CSCL 03B

Photometric observations of eclipses of Phobos by Mars were carried out by a new photoelectric scanning technique for the purpose of estimating Martian atmospheric pressure on the surface of the planet. An upper limit of 30 mb for the pressure at a mean temperature of 200°K was obtained. The observations show strong evidence of particle absorption at high levels in the atmosphere. The data suggest that the absorption level which causes the so-called "blue haze" is not higher than 10 km above the surface of the planet. The question as to what value should be adopted for the surface pressure on Mars can be solved by first answering the question as to what distribution of solid particles in the atmosphere is the most probable.   Author

N66-23779*# General Electric Co., Philadelphia.   Missile and Space Div.
USE OF A MASS SPECTROMETER TO DETERMINE THE COMPOSITION OF THE UNDISTURBED MARTIAN ATMOSPHERE FROM A HYPERSONIC ENTRY VEHICLE Final Report
M. H. Bortner, R. P. Fogaroli, H. L. Friedman, H. W. Goldstein, R. E. Simons et al   25 Oct. 1965   105 p   refs
(Contract NAS5-9602)
(NASA-CR-71307)   CFSTI: HC $4.00/MF $0.75   CSCL 22A

The use of a mass spectrometer aboard a hypersonic entry vehicle, to determine the chemical composition of the Martian atmosphere, was studied by application to minimum and maximum engineering models of the atmospheric medium. First, the heating of the entry vehicle was calculated throughout the entry and the results were applied to find the corresponding thermal response of the graphite in mass losses and temperature changes. The quantity of the ablation products was then estimated and added to the chemical kinetic information to determine the gas flow composition that enters the mass spectrometer. Thus, the factors that influenced the accuracy of the analysis were established and related to the chemical composition of the atmosphere; final model atmospheric compositions containing N_2, N, CO_2, CO, C_2N_2, CN, O_2, O, C_3 and C are shown in tables.   G.G.

N66-23787*# Ball Bros. Research Corp., Boulder, Colo.
ENGINEERING BREADBOARD MODEL, WOLF TRAP MICROBE DETECTION DEVICE Final Report
D. E. Buckendahl, L. Ried, Jr., and E. Lemberg   8 Sep. 1965   55 p   refs   Prepared for Rochester Univ.
(Grant NsG-209)
(NASA-CR-74214; F65-6)   CFSTI: HC $3.00/MF $0.50   CSCL 06B

An experimental microorganism detection device, intended eventually for a Mars landing, is described. The breadboard model optically monitors organism growth in an enrichment culture. Collection of an aerosolized dirt innoclum is accomplished by a gas operated suction pickup. Checkout equipment is described which provides automatic control and data readout. Ability of the device to withstand high temperature sterilization is shown. Recommendations for engineering improvements are made.   Author

N66-23797*# Geophysics Corp. of America, Bedford, Mass.
MASS SPECTROMETER INSTRUMENTATION FOR THE ANALYSIS OF THE MARTIAN ATMOSPHERE Final Report
R. F. K. Herzog and W. P. Poschenrieder   12 Dec. 1962   96 p   refs   Prepared for JPL
(Contracts NAS7-100; JPL-950328)
(NASA-CR-71916; GCA-TR-62-17-G)   CFSTI: HC $3.00/MF $0.75   CSCL 20C

A mass spectrometer which uses a hetero-energetic ion source without need of any specific deflection field is described. The instrument is very simple and is of great value for applications where high reliability, small size, small weight, and low power consumption are of prime importance; and where a moderate resolution is adequate. The ion source is of the inversed magnetron type, and consists of two electrodes, an anode cylinder which is concentric and surrounded by a can-shaped cathode on ground potential. The ions are under the influence of a radial electric and axial magnetic field which confines the electrons in a potential well. Special kinds of orbits which occur if the magnetic field is weak and if the ions follow essentially the straight lines of the electric force are investigated. Computations were carried out for axial symmetrical and other set-ups. A plane geometry was found to provide higher resolution along with other advantages. It was shown that under certain field conditions, velocity focusing can be achieved which permits the use of the hetero-energetic ion source as a mass spectrometer. Results of experiments with several test model instruments are presented, and evaluated. Although it was shown that simple mass spectra can be obtained with the instrument, resolution is far below the requirements for the Martian probe.   L.S.

1965
IAA ENTRIES

A65-14563 #
THE EFFECT OF FIRM DEFINITION OF THE MARS ATMOSPHERE OF THE PAYLOAD CAPABILITY OF ADVANCED MARTIAN LANDERS.
E. J. Merz (General Electric Co., Missile and Space Div., Re-entry Systems Dept., Philadelphia, Pa.).
American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 2nd, New York, N.Y., Jan. 25-27, 1965, Paper 65-22. 15 p. 5 refs.
Members, $0.50; nonmembers, $1.00.
Description of improvements which could be attained in the designed payload capabilities of advanced Martian entry/lander vehicles if the Mars atmosphere could be defined more precisely than the present 11 to 30 mb estimated range. To illustrate the improvement attainable, an advanced lander system using the Saturn V launch vehicle as a booster is discussed, together with key system trade-offs. For this lander, two systems are synthesized, one based on an 11-mb atmosphere only and the other on a 30-mb atmosphere only, both of which offer significant weight savings over the design presently dictated by the imprecision in defining the Mars atmosphere. The results indicate the importance of an early entry probe to Mars to determine atmospheric density, gradient, constituents, and other characteristics. P. K.

A65-14707
INFRARED ASTRONOMY BY BALLOON.
John Strong (Johns Hopkins University, Baltimore, Md.).
Scientific American, vol. 212, Jan. 1965, p. 28-37.
Description of the Feb. 21, 1964, and the Oct. 28, 1964, unmanned balloon flights designed to determine the water vapor content of the atmosphere of Venus. Sponsored by the USAF, the project employed a helium-filled polyester balloon to lift a combination Schmidt telescope and IR diffraction-grating spectrometer to altitudes above 80,000 ft. The telescope had a 16-in. primary mirror which was effectively stopped down to 12 in. The coarse and fine tracking systems, which are designed to enable the telescope to remain pointed at Venus for intervals of several hours, are described. Comparison of the spectra obtained with the IR spectra of several materials including liquid water, solid CO_2, and a cloud of ice crystals revealed a close match with the ice-crystal spectra. Future projects are being planned and the use of an IR telescope of 48-in. aperture is anticipated. D.H.

A65-15008 #
THEORETICAL AND EXPERIMENTAL STUDIES OF EQUILIBRIUM AND NONEQUILIBRIUM RADIATION TO BODIES ENTERING POSTULATED MARTIAN AND VENUSIAN ATMOSPHERES AT HIGH SPEEDS.
James O. Arnold, Victor H. Reis, and Henry T. Woodward (NASA, Ames Research Center, Moffett Field, Calif.).
American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 2nd, New York, N.Y., Jan. 25-27, 1965, Paper 65-116. 12 p. 27 refs.
Members, $0.50; nonmembers, $1.00.
Presentation of new theoretical predictions and extended measurements of spectral and total radiation from shock layers of vehicles traveling at hypersonic speeds into 9% and 25% CO_2, balance N_2 and 16% CO_2, 48% N_2, and 36% A gas mixtures. Spectra computed for the CO_2-N_2 mixtures show CN violet to be the predominant spectral feature for velocities from 5.0 to 9.5 km/sec. Comparison of the predictions with observations of shock layers formed about small gun-launched blunt models shows good agreement. Measurements at high ambient densities show the shock layer to be in thermochemical equilibrium. At lower densities, excessive radiation was observed and interpreted to be due to nonequilibrium processes. CN violet radiation dominates the nonequilibrium spectra. Further, the total nonequilibrium radiation

is significantly greater than that for air at similar flight conditions. To cover the possibility that the Martian atmosphere contains argon, the CO_2-N_2 study was extended to determine the effect of argon dilution. The measurements and calculations show little change in spectral emissive power for a density survey taken at 7.5 km/sec. Results of the investigation are summarized and compared with other theoretical computations and reported shock-tube measurements. (Author) F.R.L.

A65-15140
THE DARKENING WAVE ON MARS.
D. G. Rea (California, University, Space Sciences Laboratory, Berkeley, Calif.).
Nature, vol. 201, Mar. 7, 1964, p. 1014, 1015. 7 refs.
Grant No. NsG 101-61.
Paper dealing with a recent communication of the author concerning the evidence for life on Mars and, in particular, the seasonal wave of darkening and associated changes in the polarization of the dark areas. An improved rationale for a previous model (the principal feature of which is the seasonal transport of dust on and off the dark areas) explaining these phenomena is proposed. V.P.

A65-15342 #
CLOSE APPROACH OF METEOR STREAMS AND COMETS TO MARS' ORBIT.
J. Kvízová (Czechoslovak Academy of Sciences, Astronomical Institute, Ondřejov, Czechoslovakia).
Astronomical Institutes of Czechoslovakia, Bulletin, vol. 15, no. 6, 1964, p. 230-232. 8 refs.
Calculation of the heliocentric longitudes at which a number of comets and meteor streams have intersected the orbit of Mars at distances of less than 0.3 AU. A comparison of the dates of the close approaches with the dates of the blue clearing of Mars' atmosphere, as given by Kvíz, shows no correlation. More accurate results are seen to await improved data on the height of the planet's violet layer. W.M.R.

A65-15368
LISTENING IN ON SPACE.
G. W. Swenson (Illinois, University, Urbana, Ill.).
IEEE Student Journal, vol. 2, May 1964, p. 2-9. 6 refs.
Review of the field of astronomy as carried out with waves of radio wavelengths. Radio astronomy makes possible the exploitation of wavelengths between about 5 Mc and 30 Gc. In the study of solar radiation, the expansion of the observable spectrum by over 11 octaves has increased the acquisition of data manyfold. Study of such wavelengths helps to reveal the structure of the solar atmosphere, makes possible the observation of physical processes in high-temperature, fully-ionized gases, and contributes greatly to the problem of solar-terrestrial relationships. Use of radio waves has permitted the detailed mapping of the Galaxy, and has assisted in the interpretation of its hydrogen-line model. Radio astronomy's task in support of cosmological research is to discover many thousands of weak radio galaxies, and to measure their strengths as accurately as possible. Results of radio-telescopic examination of Jupiter are discussed. Problems of radio astronomy are angular resolution and sensitivity, and their solution requires complex antennas, and utilization of the best low-noise receiving techniques. Continuous efforts must be made to increase signal power. The science has also contributed some of the most essential data for the engineering of communications systems. F.R.L.

A65-15454 #
THEORETICAL MODELS OF CYTHEREAN AND MARTIAN UPPER ATMOSPHERES. I - DISSOCIATION LAYERS.
Mikio Shimizu (Ochanomizu University, Dept. of Physics, Tokyo, Japan).
Progress of Theoretical Physics, vol. 31, June 1964, p. 1153-1155. 13 refs.
Investigation of solar-planetary relationships, particularly upper atmosphere phenomena such as ionospheres and aurorae, on the basis of data from ground-based and space-probe observations. Tables show the following: (1) upper atmosphere models

and heights of the dissociation layers of Venus and Mars, and (2) the amounts of CO on Venus. It is stated that the calculations have shown that the uncertainties of scale heights and temperatures do not cause serious changes to the results. The existence of small amounts of CO on Mars and of O_2 on both planets hardly affects them. On the other hand, the substitution of effective temperature for solar radiation from 4700 to 5000°K nearly doubles the quantities of CO and O. They also depend considerably on the values of the recombination rates. The effect of atmospheric density is only to change the heights of the dissociation layers. M.M.

A65-15610

THEORETICAL PERFORMANCE OF METALS BURNING NITROGEN FOR PROPULSION IN THE MARTIAN ATMOSPHERE.
J. Q. Weber and K. H. Mueller (North American Aviation, Inc., Rocketdyne Div., Canoga Park, Calif.).
IN: CHEMICAL ENGINEERING TECHNIQUES IN AEROSPACE.
Edited by D. J. Simkin.
Chemical Engineering Progress, vol. 60, Symposium Series, no. 52. [A65-15607 06-28]
New York, American Institute of Chemical Engineers, 1964, p. 17-22.

Different techniques by which Martian nitrogen might be used as a propellant with primary emphasis on: (1) liquefaction and subsequent use as a rocket oxidizer or working fluid, and (2) use as the oxidizer and working fluid in a ramjet. Theoretical rocket performance of liquid nitrogen with boron, aluminum, beryllium, and nitric-acid beryllium were calculated and found to fall in the range 200 to 280 sec (Pc = 250 psia and $\mathcal{C} \approx 40$). Of the above fuels, boron was found to give the best ramjet performance. A theoretical analysis is presented of the ramjet performance over a mixture ratio range of 4 to 32 (N_2/B) and a Mach-number range of 2 to 6. Fuel-based impulses ranged from 550 to 1350.

(Author) W.M.R.

A65-15619

THERMAL PROBLEMS OF ABLATIVE MATERIALS IN VARIOUS PLANETARY ATMOSPHERES.
R. M. Lurie, S. Georgiev, and P. Levine (Avco Corp., Research and Advanced Development Div., Wilmington, Mass.).
IN: CHEMICAL ENGINEERING TECHNIQUES IN AEROSPACE.
Edited by D. J. Simkin.
Chemical Engineering Progress, vol. 60, Symposium Series, no. 52. [A65-15607 06-28]
New York, American Institute of Chemical Engineers, 1964, p. 91-98.

Study of heat shield requirements and heat transfer phenomena on contact of a probe with the atmospheres of Earth, Mars, and Venus. Unmanned exploration of Mars and Venus, now in the planning stage, poses the problem of entry velocities into these planets as high as 45,000 fps and re-entry into the Earth's atmosphere at speeds up to 75,000 fps. Two promising heat shield materials are described: dense carbon-reinforced charring resins are particularly effective against high radiative heating rates, while low-density char-forming resins have especially low thermal conductivities. These materials also show mechanical and thermal properties that are compatible with space and pre-entry environmental requirements. The preliminary results are presented of solar furnace experiments on these materials. W.M.R.

A65-15676 #

INFRARED SPECTRUM OF MERCURY (λ 1.0 - 3.9 μ) [INFRA-KRASNYI SPEKTR MERKURIIA (λ 1.0 - 3.9 μ)].
V. I. Moroz (Moskovskii Gosudarstvennyi Universitet, Astronomicheskii Institut, Moscow, USSR).
Astronomicheskii Zhurnal, vol. 41, Nov.-Dec. 1964, p. 1108-1117.
15 refs. In Russian.

Observation, in October 1963, of the Mercury spectrum in the region 1.0 - 3.9 μ, by means of a 125-cm reflector and two IR spectrometers with PbS-photoresistances cooled with solid CO_2 or liquid N_2. The CO_2-lines are found to be more pronounced in Mercury's atmosphere as compared to the telluric lines, and a CO_2 content of 0.3 to 7 gm/cm^{-2} is established. A model of Mercury's atmosphere is designed, assuming 10% of CO_2 and 90%

of N_2 contents. The critical level temperature is found to be relatively low as a result of a heat flux from the illuminated hemisphere into the obscured hemisphere, despite the intensive ionizing radiation. The upper content level in the planet's atmosphere for CO, N_2O, NH_3, and CH_4, and the relative energy distribution in the planet's spectrum are estimated. V.Z.

A65-15691

NEW OBSERVATIONS OF THE INFRARED SPECTRUM OF VENUS (λ = 1.2 - 3.8 μ).
V. I. Moroz (Gosudarstvennyi Astronomicheskii Institut, Moscow, USSR).
(Astronomicheskii Zhurnal, vol. 41, July-Aug. 1964, p. 711-719.)
Soviet Astronomy, vol. 8, Jan.-Feb. 1965, p. 566-572. 24 refs. Translation.

Discussion of some of the results of observations of the infrared spectrum of Venus conducted in the wavelength regions of λ1.2-2.5 and 2.8-3.8 μ, using two spectrometers with cooled lead-sulphide photocells attached to a 125-cm reflector. Both wavelengths and equivalent widths of the planetary absorption bands are measured. It is found that some weak absorption bands could not be identified. The intensities of "hot" CO_2 bands show that the temperature in the region of their formation is less than the laboratory temperature. Estimates are made of the CO_2 abundance, total pressure above the cloud layer, the coefficient of volume scattering in the cloud layer, and concentration of scattering particles. The presence of a band at about 2.35 μ, apparently due to CO, is confirmed. The albedo of Venus at 3.3 μ comprises about 1%. Absorption observed in the region λ > 3 μ is probably responsible for a strong greenhouse effect which heats the planetary surface. J.R.

A65-15763 #

X-RAYS IN THE AURORAL ZONES.
A. I. Ershkovich (Akademiia Nauk SSSR, Institut Fiziki Atmosfery, Moscow, USSR).
(Geomagnetizm i Aeronomiia, vol. 4, Mar.-Apr. 1964, p. 412-414.)
Geomagnetism and Aeronomy, vol. 4, no. 2, 1964, p. 324, 325. 7 refs. Translation.

Derivation of expressions for calculating the intensity of X-radiation in the regions of aurorae polaris on the assumption that the atmosphere is practically transparent. It is noted that measurements of the intensity of X-ray radiation in the regions of aurorae polaris of a planet can be used to determine its magnetic moment.

A65-15944 #

A MARS SKIP-OUT CAPSULE FOR IN-FLIGHT ATMOSPHERIC MEASUREMENTS.
Haim Kennet and John F. Wayne (Boeing Co., Aero-Space Div., Flight Technology Dept., Seattle, Wash.).
American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 2nd, New York, N.Y., Jan. 25-27, 1965, Paper 65-23. 16 p. 17 refs.
Members, $0.50; nonmembers, $1.00.

Discussion of the use of a ballistic skip-out capsule, considered to be a feasible method of determining the characteristics of the Martian stratosphere. The capsule would be injected into the atmosphere from either a fly-by bus or an orbiter. On-board accelerometers, a densitometer, a radar altimeter and a mass spectrometer provide the desired information concerning the density-altitude profile in the stratosphere as well as ambient composition. The capsule, though sterilized by the best available techniques to avoid biological contamination of the planet, is designed to exit the atmosphere hyperbolically. Furthermore, as an added precaution, a nonablating structure is used, and all propulsion maneuvers are accomplished well outside the sensible atmosphere. The deposition of either ablation or engine exhaust products on the planet is thus avoided. Capsule performance has been investigated parametrically, considering all pertinent mission phases, namely: injection, penetration, and post-encounter. The studies included propulsion requirements, configuration requirements, trajectories, entry dynamics, entry loads and heating, communication and power requirements, as well as the effects of atmosphere uncertainties. From these, system and mission parameters have been established, including (1) optimum injection

points (from highly elliptic orbits about Mars) that minimize propellant weight; (2) magnitude and direction of the required total impulse; (3) minimum capsule nose radius; (4) optimum capsule ballistic coefficient; (5) optimum total system weight; (6) antenna beam-width requirements; (7) thermal protection and structural weights, and (8) capsule configuration requirements. On the basis of the parametric studies, an optimum skip-out capsule has been conceptually designed for a typical mission and its performance determined for both nominal and off-design conditions. (Author) F.R.L.

A65-16606 #
EARTH RE-ENTRY SIMULATION OF PLANETARY ENTRY ENVIRONMENT.
H. Kennet and R. A. Taylor (Boeing Co., Aero-Space Div., Flight Technology Dept., Seattle, Wash.).
American Institute of Aeronautics and Astronautics and NASA, Flight Testing Conference, Huntsville, Ala., Feb. 15-17, 1965, Paper 65-218. 16 p. 12 refs.
Members, $0.50; nonmembers, $1.00.
Study of the feasibility of using re-entry through the Earth's atmosphere to simulate the entry environment for a Mars or Venus entry vehicle. The key subsystems associated with the entry phase of unmanned Mars or Venus exploration systems and the environmental characteristics influencing them are examined, and all similitude relationships which must be fulfilled to ensure a simulation of the planetary entry environment are derived. It is found that the simultaneous simulation of those entry environmental characteristics that are independent of ambient atmosphere composition, such as deceleration, aerodynamic loads, and convective heating, is feasible, and does not impose unrealistic requirements. In addition, the total radiative heat load can be simulated exactly, and the radiative heating history closely. Ablative mass losses of the thermal protective system can also be simulated, as can communication blackout. P.K.

A65-16909
RADIO EMISSION OF THE SUN AND PLANETS [RADIOIZLUCHENIE SOLNTSA I PLANET].
V. V. Zhelezniakov.
Moscow, Izdatel'stvo Nauka, 1964. 560 p. In Russian.
This monograph presents the results of worldwide radio-telescopic studies of the emission from the Sun, Moon, and planets of the solar system, and discusses the problems of the mechanism of these radio emissions. Chapter 1 reviews the physical conditions on the Sun, the Moon, and the planets Mercury, Venus, Mars, Jupiter, and Saturn. Chapter 2 outlines the basic features of extraterrestrial radio emission and the methods used to study this emission. The following are covered: the frequency spectrum of radio emission; the antenna temperature and the effective temperature of radio emission; multichannel radio receivers and radio spectrographs; the requirements posed to antenna systems in radio astronomy; parabolic antennas; the two-element interferometer; the Mills cross; the polarization of radio emission; the effect of the Earth's atmosphere on the nature of the observed radio emission; the absorption of radio waves in the troposphere and ionosphere; the effects associated with the refraction of radio waves in the atmosphere; and the change in polarization of radio emission in the passage through the ionosphere. Chapter 3 gives the results of observations of the radio emission from the quiet Sun. The following are covered: the frequency spectrum and intensity of this radio emission; the dependence of solar effective temperature upon wavelength; and the distribution of radio brightness over the solar disk. Chapter 4 presents the results of observations of the sporadic radio emission of the Sun, including: the slowly varying component; microwave bursts; solar storms; Type-II, Type-III, Type-IV, and Type-V bursts; rapidly drifting decimeter bursts; continuous storms; short-lasting broadband bursts; and double bursts with inverse frequency drift. Chapter 5 gives the results of observations of the radio emission from the Moon and planets, including the sporadic radiation of Jupiter, and the continuous radiation of planets. Chapter 6 examines the propagation of radio waves in the solar corona. It covers: the propagation of electromagnetic waves in an isotropic and a magnetoactive coronal plasma, and in a homogeneous plasma in the presence of a constant magnetic field; the polarization of the emission from a coronal plasma; the

interaction of electromagnetic waves under the effect of a quasi-transverse magnetic field; the calculation of this interaction by means of phase integrals; the interpretation of solar radio emission in terms of the wave interaction effect in the region of a quasi-transverse magnetic field in the corona; and the problem of the ejection of charged particles from the corona. Chapter 7 deals with the generation and absorption of electromagnetic waves in the solar corona, including: the emission and absorption of electromagnetic waves in an equilibrium plasma; the transport equation of radiation; the emission of electromagnetic waves by individual particles; the absorption of electromagnetic waves in an isotropic and in a magnetoactive plasma; the gyroresonance absorption in the solar corona; and the emission, absorption, and amplification of electromagnetic waves in a nonequilibrium plasma. Chapter 8 outlines the theory of thermal solar radiation. It reviews the theory of the radiation of the quiet Sun, and the mechanism of this radiation; the theory of the B-component for a simple model of the corona and the chromosphere; the interpretation of the peculiarities and the distribution of radio brightness over the solar disk on the basis of a complex model of the corona and chromosphere; and the origin of the slowly varying component of solar radio emission. Chapter 9 reviews the theory of nonthermal solar radiation, including the generation of sporadic continuum-type radiation; the origin of microwave bursts, and of the intensive radio emission associated with the sunspots; the generation of Type-I, Type-II, Type-III bursts; and the mechanism of these bursts. Chapter 10 examines the origin of the radiation from the planets and the Moon. It discusses the hypothesis of the mechanism of the sporadic radiation from Jupiter; the "storm" hypothesis; the mechanism of natural plasma oscillations; the origin of the continuous radiation from Jupiter and Saturn; the radiation belts as a source of the decimeter radiation from Jupiter; the radio sources of Venus; and the theory of the radio emission of the Moon. V.P.

A65-16981
ASTROCHEMISTRY - THE LONG-DISTANCE SCIENCE.
Francis O. Rice (Notre Dame University, Radiation Laboratory and Dept. of Chemistry, Notre Dame, Ind.).
Chemical and Engineering News, vol. 43, Feb. 15, 1965, p. 88-94, 96-102.
General outline of conceivable chemical events in outer space, covering occurrence, state, and behavior of the elements on the planets and the Moon. Meteorites are discussed as a tangible source of astrochemical information, and the physical and astronomical characteristics of the planets, the escape speed of the constituent molecules of a planet's atmosphere, and some chemical figures for meteorites are tabulated. Free radicals are mentioned as a possible source of the colored zones on Jupiter. The atmospheric chemical and temperature profile, the atmosphere as a participant in life cycle, the Ranger pictures of the lunar surface, and extraterrestrial life are other topics. V.Z.

A65-16989 #
DEFINING MARS' ATMOSPHERE - A GOAL FOR THE EARLY MISSIONS.
Alvin Seiff and David E. Reese, Jr. (NASA, Ames Research Center, Vehicle Environment Div., Moffett Field, Calif.).
Astronautics and Aeronautics, vol. 3, Feb. 1965, p. 16-21. 9 refs.
Technique for measuring the atmospheric properties of planets through the response of an entry vehicle to the atmosphere. This response can be sensed in many forms - in the deceleration, pitching oscillation, heating, and radiation exposure, among others - and it can be analyzed to define the properties of the atmosphere encountered. It is deemed necessary to define the profile of atmospheric density as a function of altitude in order to guide the design of payload-landing vehicles and to provide a firm base for long-range studies of manned entry systems. Integration of the density profile, once obtained, also permits the definition of static pressure profile and the RT product profile. These and atmospheric temperature serve to define the atmospheric structure. Atmospheric composition can also affect the aerodynamics of certain entry-vehicle configurations and the heating, especially the radiative heating. The primary experiment of this kind proposed for the Mars atmospheric probe involves measuring nitrogen, as yet only assumed to be a principal constituent of the Mars atmosphere, and its mole

35

fraction. This can be done by measuring the intensity history of the prominent cyanogen violet bands. The possibility of detecting trace amounts of water vapor remains undemonstrated. W.M.R

A65-17164
STUDY OF THE ELONGATION OF THE HORNS OF THE CRESCENT OF VENUS IN JUNE 1964 [ETUDE DE L'ALLONGEMENT DES CORNES DU CROISSANT DE VENUS EN JUIN 1964].
Audouin Dollfus and Eric Maurice (Paris, Observatoire, Section d'Astrophysique, Meudon, Seine-et-Oise, France).
Académie des Sciences (Paris), Comptes Rendus, vol. 260, no. 2, Jan. 11, 1965, p. 427-430. In French.
Discussion of a photometric study of the aureole which elongates the horns of Venus at the time of inferior conjunction. Evidence indicates that the atmosphere above the cloud layer is charged with particles of about 1-μ diameter whose number decreases by a factor of 2 about every 2.8 km and whose coefficient of diffusion per cm^3 at the opposition of the Sun has a value of about 3.10^{-8} stilb/phot at the level of the cloud layer. F.R.L.

A65-17189
AN UPPER LIMIT TO THE MOLECULAR OXYGEN CONTENT OF THE VENUS ATMOSPHERE.
Hyron Spinrad (California, University, Berkeley Astronomical Dept., Berkeley; California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.) and E. H. Richardson (Dominion Astrophysical Observatory, Royal Oak, British Columbia, Canada).
Astrophysical Journal, vol. 141, Jan. 1, 1965, p. 282-286. 16 refs.
Presentation of an improved determination of the upper limit to the O_2 content of the visible Venus atmosphere, obtained with the Doppler-shift technique and a curve-of-growth analysis. It is stated that the lack of displaced Cytherean O_2 lines near the tail of the telluric A-band leads to a limit of 57 cm-atm O_2, less than the terrestrial abundance by a factor of 2800. This result is said to be in disagreement with the tentative detection of Venus oxygen lines claimed by Prokofiev and Petrova. These spectrograms include a contribution of light scattered from fairly deep in the Venus atmosphere, as evidenced by total pressure measured from nearby CO_2 line widths. The relative abundance of Venus oxygen is less than 8×10^{-5}. This negative result is interpreted, and the possibilities of future attempts to detect Cytherean molecular oxygen from space are briefly discussed. (Author) M.M.

A65-17213 #
A THEORETICAL INVESTIGATION OF JOVIAN UPPERATMOSPHERE. I - IONIZATION AND DISSOCIATION.
Mikio Shimizu (Ochanomizu Women's University, Dept. of Physics, Tokyo, Japan).
Progress of Theoretical Physics, vol. 32, Dec. 1964, p. 977-979. 9 refs.
Investigation of the effect of the solar ionizing radiation on the Jovian upper atmosphere. Jupiter's microwave radiation may be separated into three components: (1) the $130^{\circ}K$ thermal radiation; (2) the nonpolarized, nonthermal radiation (possibly due to a Jovian ionosphere); and (3) the polarized nonthermal radiation (possibly due to the synchrotron radiation of electrons in a Jovian Van Allen belt). The results of the calculation of hydrogen and electron density distribution in the Jovian upper atmosphere are presented in graphical form. F.R.L.

A65-17398 #
EARTH ENTRY FLIGHT TEST OF MARS ENTRY VEHICLES.
F. G. Beuf, G. D. Katz, and R. J. Kern (General Electric Co., Missile and Space Div., Re-entry Systems Dept., Philadelphia, Pa.).
American Institute of Aeronautics and Astronautics and NASA, Flight Testing Conference, Huntsville, Ala., Feb. 15-17, 1965, Paper 65-219. 16 p.
Members, $0.50; nonmembers, $1.00.
Systems studies to assess the degree to which Martian-entry conditions can be simulated in an Earth-entry test program, and an estimate of the launch vehicle, tracking, cost, and schedule requirements for such a test series. The value of the test program

is seen to lie in its ability to demonstrate, in actual operation, the validity of the concept of atmosphere-sensing instrumentation systems, in its proofing of the operation of aerodynamic retardation systems, and in its demonstration of communications link operation under actual conditions of vehicle motion and plasma sheath blackout. Limitations are found to include an oversimulation of the Mars-entry heating profile, brought about by the relatively high Earth-entry convective heat flux, and the high costs of full-scale tests of large entry systems. A brief discussion of the suitability of available launch vehicles and a hypothetical test program for a small Mars atmospheric probe illustrate the applications of Earth-entry tests to presently hypothesized Mars-entry hardware.
(Author) W.M.R.

A65-17422
SOLAR SYSTEM ASTROPHYSICS.
J. C. Brandt (Kitt Peak National Observatory, Space Div., Tucson, Ariz.) and P. W. Hodge (California, University, Dept. of Astronomy, Berkeley, Calif.).
New York, McGraw-Hill Book Co., Inc., 1964. 457 p.
$12.50.
Intended for use as a text in advanced undergraduate or graduate courses in solar system astronomy and space physics, the work is considered also of value to workers in various fields of space research as a fairly high-level introduction to the astrophysics of the solar system. The book discusses the basic principles of celestial mechanics, and presents a few applications appropriate to other solar system problems. Basic solar data are reviewed, and the methods of determining the internal structure of the Sun are outlined, as well as the present knowledge of its formation and evolution. The fourth and fifth chapters discuss the physical conditions in its atmosphere and the sixth chapter deals with the wide variety of solar activity, while, in the seventh chapter, which discusses observations of the solar spectrum, the properties of the terrestrial atmosphere as they affect solar radiation are also examined. Further on, the physics of the interplanetary gas is considered. Comets, meteors, meteorites, asteroids, and interplanetary dust each have chapters to themselves. The fourteenth chapter briefly introduces the subject of the planets and two subsequent chapters discuss planetary interiors and planetary surfaces. The atmospheres of the Jovian planets and of the terrestrial planets are described and discussed. The concluding chapter deals with the Moon and other satellites. Bibliographical notes are given at the end of each chapter. A subject index is presented. The text is illustrated with numerous diagrams and photographs. F.R.L.

A65-17992
NITROGEN OXIDES ON MARS.
Carl Sagan (Harvard University, Harvard College Observatory; Smithsonian Institution, Smithsonian Astrophysical Observatory, Cambridge, Mass.), Philip L. Hanst (Avco Corp., Research and Advanced Development Div., Wilmington, Mass.), and Andrew T. Young (Harvard University, Harvard College Observatory, Cambridge, Mass.).
Planetary and Space Science, vol. 13, Jan. 1965, p. 73-88. 51 refs.
Comprehensive analysis of the case for the presence of nitrogen oxides on Mars. Analyses of observations at a variety of wavelengths place a firm upper limit on the Martian NO_2 abundance of 1 mm-atm. Nitrogen dioxide is a highly photolabile gas and will be photodissociated by visible and ultraviolet radiation on Mars. The photochemical equilibria of nitrogen oxides on Mars have been computed from the observational upper limits on the NO and O_2 abundances. The same procedure gives consistent results for the Earth, at locales free from urban pollution. The corresponding theoretical upper limit to the abundance of NO_2 on Mars is 1 mm-atm, when reactions with water are neglected. When reactions with water are considered, the NO_2 abundance is further diminished. These low abundances are regarded as inadequate to account for the Martian observables discussed by Kiess et al. The one Martian phenomenon in which it is suggested that nitrogen peroxide may play a role is the blue haze, where 1 mm-atm may help to explain not only the general blue and violet opacity, but also the dependence of the opacity on time and position. The required abundance of NO must then be > 50 cm-atm. (Author) A.B.K.

A65-18203
MOLECULAR SPECTROSCOPY AND ASTROPHYSICAL PROBLEMS.
G. Herzberg (National Research Council, Div. of Pure Physics,
Ottawa, Canada).
(Optical Society of America, Ives Medal Award Lecture, New York,
N. Y., Oct. 9, 1964.)
Optical Society of America, Journal, vol. 55, Mar. 1965,
p. 229-238. 99 refs.
    Consideration of molecular problems of astrophysics - such as
the question of the presence of molecular hydrogen in planets and
in the interstellar medium, or the question of the composition of
comets - which have stimulated a good deal of laboratory and the-
oretical work in molecular spectroscopy. It is stated that, con-
versely, advances in molecular spectroscopy have made possible
a better understanding of many astrophysical phenomena. Exam-
ples for this mutual cross-fertilization are discussed.
(Author) M. M.

A65-18223
HOT SHADOWS OF JUPITER.
Robert L. Wildey (Carnegie Institution of Washington and California
Institute of Technology, Mount Wilson and Palomar Observatories;
California Institute of Technology, Div. of Geological Sciences,
Pasadena, Calif.).
Science, vol. 147, Feb. 26, 1965, p. 1035, 1036.
    Presentation of photometric observations of Jupiter. On the
evenings of 26 Oct. and 15 Dec. 1962, while the disk of Jupiter was
being scanned for thermal emission in the 8- to 14-micron wave-
length region, a large enhancement was discovered in the emission
from shadows cast on Jupiter by the Jovian satellites Ganymede
and Europa. However, on the evening of 14 Dec. 1964, the shadow
of satellite Io was observed and no enhancement was detected. It
is concluded that the effect is thus variable with time.
(Author) M. M.

A65-18475
COMMUNICATIONS OF THE LUNAR AND PLANETARY
LABORATORY. VOLUME 2 (Numbers 31-35).
Tucson, University of Arizona Press, 1964. 173 p.

CONTENTS:
    INFRARED SPECTRA OF STARS AND PLANETS. IV - THE
SPECTRUM OF MARS, 1-2.5 MICRONS, AND THE STRUCTURE
OF ITS ATMOSPHERE. Gerard P. Kuiper (Arizona, University,
Tucson, Ariz.), p. 79-112. 33 refs. [See A65-18476 08-30]
    A DETERMINATION OF THE COMPOSITION AND SURFACE
PRESSURE OF THE MARTIAN ATMOSPHERE. T. C. Owen
(Kitt Peak National Observatory; Arizona, University, Tucson,
Ariz.) and G. P. Kuiper (Arizona, University, Tucson, Ariz.),
p. 113-132. [See A65-18477 08-30]
    A DETERMINATION OF THE MARTIAN CO_2 ABUNDANCE.
T. C. Owen (Arizona, University; Kitt Peak National Observatory,
Tucson, Ariz.), p. 133-140. 7 refs. [See A65-18478 08-30]
    LABORATORY SPECTRA FOR TESTING THE PRESENCE
OF MINOR CONSTITUENTS IN PLANETARY ATMOSPHERES.
I - CH_4, NH_3, N_2O, CO, COS, REGION 1-2.5 μ. Gerard P.
Kuiper and Dale P. Cruikshank (Arizona, University, Tucson,
Ariz.), p. 141-165. [See A65-18479 08-30]
    IMPROVED TEST FOR NO_2 ON MARS. James V. Marshall
(Arizona, University, Tucson, Ariz.), p. 167-173. 8 refs.
[See A65-18480 08-30]

A65-18476 #
INFRARED SPECTRA OF STARS AND PLANETS. IV - THE
SPECTRUM OF MARS, 1-2.5 MICRONS, AND THE STRUCTURE
OF ITS ATMOSPHERE.
Gerard P. Kuiper (Arizona, University, Lunar and Planetary
Laboratory, Tucson, Ariz.).
(NASA, Conference, Oct. 1, 2, 1963, Washington, D. C.).
IN: COMMUNICATIONS OF THE LUNAR AND PLANETARY
LABORATORY. VOLUME 2 (Numbers 31-35).
Tucson, University of Arizona Press, 1964, p. 79-112. 33 refs.
Grant No. NsG 161-61.
    Presentation of 1 to 2.5 μ spectra of the planet Mars obtained
with the 82-in. telescope of the McDonald Observatory, including

lunar comparisons and a limited set of laboratory calibrations.
The IR spectra are examined for the presence of constituents other
than CO_2 (CO, CH_4, NH_3, H_2S, NO, N_2O, HCHO, and COS), and
for the presence of isotopic bands of CO_2. The O^{18} isotopic band
at λ 2.15 μ is definitely present in the Martian spectra and allows
a provisional determination of the O^{18}/O^{16} ratio relative to the
Earth. The evidence is strong, though not yet conclusive, that this
ratio is larger on Mars than on the Earth. The other gases listed
are all below the threshold of detection, with the upper limits given
in the text. The Martian spectral intensities are also expressed
in terms of those derived for the Moon; the ratio spectra so ob-
tained for Mars are summarized graphically. In the introductory
parts of the paper a discussion is given of the types of atmospheric
particles detected in the Martian atmosphere and the information
that may be derived therefrom. A rough value of the atmospheric
pressure (10 to 20 mb) is thus derived.   (Author) D. H.

A65-18477 #
A DETERMINATION OF THE COMPOSITION AND SURFACE
PRESSURE OF THE MARTIAN ATMOSPHERE.
T. C. Owen (Kitt Peak National Observatory; Arizona, University,
Lunar and Planetary Laboratory, Tucson, Ariz.) and
G. P. Kuiper (Arizona, University, Lunar and Planetary Labora-
tory, Tucson, Ariz.).
IN: COMMUNICATIONS OF THE LUNAR AND PLANETARY
LABORATORY. VOLUME 2 (Numbers 31-35).
Tucson, University of Arizona Press, 1964, p. 113-132.
Grants No. NsG 61-161; No. NsG 223-61; No. Nonr (G)-0050-62;
No. ONR-00014-64.
    Calibration of 1 to 2.5 μ Martian spectra using laboratory
spectra of pure CO_2 and mixtures containing CO_2, N_2, and Ar.
Pathlengths up to 3.6 km are used and pressures down to 4 mm.
With the aid of the total CO_2 content (based on the Mt. Wilson
spectrum) preliminary values are derived for the pressure in the
Martian atmosphere and the total amount of gases other than CO_2.
The values obtained are 17 ± 3 mb (13 mm Hg) and $(N_2 + Ar)/CO_2 \approx 6$.
Arguments are given indicating that the Ar/N_2 ratio is probably
similar to that for the Earth atmosphere ($\simeq 10^{-2}$) and that the O_2
content is probably less than 7 cm-atm.   (Author) D. H.

A65-18478 #
A DETERMINATION OF THE MARTIAN CO_2 ABUNDANCE.
T. C. Owen (Arizona, University, Lunar and Planetary Laborato-
ry; Kitt Peak National Observatory, Tucson, Ariz.).
IN: COMMUNICATIONS OF THE LUNAR AND PLANETARY
LABORATORY. VOLUME 2 (Numbers 31-35).
Tucson, University of Arizona Press, 1964, p. 133-140. 7 refs.
ONR Contract No. NR 046-791.
    Presentation of two independent determinations of the CO_2
content of the Martian atmosphere derived from the Mt. Wilson
plate obtained by Kaplan, Münch, and Spinrad. Observations and
experimental procedures are described and solar observations and
laboratory calibrations are discussed. An appendix on atmospheric
temperature and the 1.05-μ CO_2 bands and a note added in proof
are included.   D. H.

A65-18479 #
LABORATORY SPECTRA FOR TESTING THE PRESENCE OF
MINOR CONSTITUENTS IN PLANETARY ATMOSPHERES. I -
CH_4, NH_3, N_2O, CO, COS, REGION 1-2.5 μ.
Gerard P. Kuiper and Dale P. Cruikshank (Arizona, University,
Lunar and Planetary Laboratory, Tucson, Ariz.).
IN: COMMUNICATIONS OF THE LUNAR AND PLANETARY
LABORATORY. VOLUME 2 (Numbers 31-35).
Tucson, University of Arizona Press, 1964, p. 141-165.
Grant No. NsG 161-61.
    Presentation of five reference spectra obtained with a PbS
spectrometer operating in part of the region where rotation-
vibration bands occur. The laboratory spectra presented were
made with the PbS spectrometer described previously by Kuiper
et al. Absorption cells of various lengths were made of glass
tubing; the light source was an incandescent laboratory lamp.

The spectra show, in addition to the absorption of CH_4, NH_3, N_2O, CO, and COS, absorptions caused by CO_2 and H_2O in the spectrometer and the laboratory (with some enrichment of CO_2 due to evaporating dry ice). The total path in the spectrometer and laboratory was about 3 m.   D. H.

A65-18480 #
IMPROVED TEST FOR NO_2 ON MARS.
James V. Marshall (Arizona, University, Lunar and Planetary Laboratory, Tucson, Ariz.).
IN: COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY. VOLUME 2 (Numbers 31-35).
Tucson, University of Arizona Press, 1964, p. 167-173. 8 refs.
Grant No. NsG 161-61.
Derivation, on the basis of new laboratory tests and micro-photometer traces of Mt. Wilson coudé spectra, of an upper limit of 8 micron-atm of NO_2 in a vertical column of the Martian atmosphere. This is two orders of magnitude less than the previous limit and appears to remove empirical arguments for the presence of this gas in the (normal) Martian atmosphere.   (Author) D. H.

A65-18553 #
A MICROWAVE RADIOMETER AND MEASUREMENT OF JUPITER RADIATION [RADIOMETR DETSIMETROVOGO DIAPAZONA I IZMERENIE SOBSTVENNOGO IZLUCHENIIA IUPITERA].
O. N. Rzhiga, G. I. Slobodeniuk, V. N. Titov, and Z. G. Trunova (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR).
Radiotekhnika i Elektronika, vol. 10, Feb. 1965, p. 364-367.
12 refs. In Russian.
Description of a modulation microwave radiometer used to measure the intensity of Jupiter radiation at a frequency of about 700 Mc in October 1963. A block-diagram of the instrument is included. The value of the average Jupiter temperature obtained from a series of observations was 12,000°K. The results are shown to confirm the law of intensity variations in Jupiter radiation with wavelength.   J. R.

A65-18967
PHYSICS OF THE MOON AND PLANETS [FIZIKA LUNY I PLANET].
Edited by I. K. Koval'.
Kiev, Naukova Dumka, 1964. 140 p. In Russian.

CONTENTS:
POLYCHROMATIC POLARIMETRY OF SOME LUNAR AREAS [MNOGOTSVETNAIA POLIARIMETRIIA NEKOTORYKH UCHASTKOV LUNY]. V. V. Avramchuk, p. 3-15. 16 refs. [See A65-18968 09-30]
SPECTROPHOTOMETRY OF DETAILS ON THE LUNAR SURFACE [SPEKTROFOTOMETRIIA OB'EKTOV LUNNOI POVERKH-NOSTI]. M. N. Mironova, p. 16-29. 9 refs. [See A65-18969 09-30]
SPECTRAL INVESTIGATIONS OF THE LUNAR SURFACE [SPEKTRAL'NYE ISSLEDOVANIIA LUNNOI POVERKHNOSTI]. A. N. Sergeeva, p. 30-45. [See A65-18970 09-30]
STUDY OF OPTICAL PROPERTIES OF THE ATMOSPHERE AND SURFACE OF MARS [K IZUCHENIIU OPTICHESKIKH SVOISTV ATMOSFERY I POVERKHNOSTI MARSA]. I. K. Koval', p. 46-53. 12 refs. [See A65-18971 09-30]
BRIGHTNESS DISTRIBUTION IN THE MARGINAL ZONE OF MARS [RASPREDELENIE IARKOSTI V KRAEVOI ZONE MARSA]. L. A. Bugaenko, O. I. Bugaenko, I. K. Koval, and A. V. Morozhenko, p. 54-57. [See A65-18972 09-30]
RESULTS OF POLARIMETRIC OBSERVATIONS OF MARS FROM 1962 TO 1963 [REZUL'TATY POLIARIMETRICHESKIKH NABLIUDENII MARSA V 1962-1963 GG]. A. V. Morozhenko, p. 58-80. 19 refs. [See A65-18973 09-30]
METHOD AND RESULTS OF DETERMINATION OF OPTICAL PARAMETERS OF THE MARTIAN ATMOSPHERE AND SURFACE [METODIKA I RESUL'TATY OPREDELENIIA OPTICHESKIKH PARAMETROV ATMOSFERY I POVERKHNOSTI MARSA]. A. V. Morozhenko and E. G. Ianovitskii, p. 81-91. 20 refs. [See A65-18974 09-30]
APPROXIMATE SOLUTION OF THE PROBLEM OF DIFFUSE REFLECTION AND TRANSMISSION OF LIGHT BY ATMOSPHERES OF PLANETS FOR AN ARBITRARY DISPERSION COEFFICIENT

[PRIBLIZHENNOE RESHENIE ZADACHI O DIFFUZNOM OTRAZHE-NII I PROPUSKANII SVETA ATMOSFERAMI PLANET PRI PROIZVOL'NOI INDIKATRISE RASSEIANIIA]. E. G. Ianovitskii, p. 92-110. 20 refs. [See A65-18975 09-30]
AUTOMATIC POLARIMETER OF THE MAIN ASTRONOMICAL OBSERVATORY OF THE ACADEMY OF SCIENCES OF THE UKRAINIAN SSR [AVTOMATICHESKII ELEKTROPOLIARIMETR GAO AN USSR]. O. I. Bugaenko, p. 111-125. 5 refs. [See A65-18976 09-14]
TYPES OF COMET TAILS [TIPY KOMETNYKH KHVOSTOV]. A. A. Demenko, p. 126-138. 70 refs. [See A65-18977 09-30]

A65-18971 #
STUDY OF OPTICAL PROPERTIES OF THE ATMOSPHERE AND SURFACE OF MARS [K IZUCHENIIU OPTICHESKIKH SVOISTV ATMOSFERY I POVERKHNOSTI MARSA].
I. K. Koval'.
IN: PHYSICS OF THE MOON AND PLANETS [FIZIKA LUNY I PLANET].
Edited by I. K. Koval'.
Kiev, Naukova Dumka, 1964, p. 46-53. 12 refs. In Russian.
Study of the problem of brightness distribution along the visible radius of Mars. Results obtained by other authors for narrow re-gions of the spectrum over a range of 400 to 900 m μ are discussed. It is concluded that, within this range of wavelengths, the Martian atmosphere possesses mainly scattering properties. The darkening of the limb has its maximum at about 650 mμ. A decrease in the limb darkening to the left of this wavelength is due to a scattering similar to that of the molecular type. To the right of this wave-length, this decrease is attributed to the scattering by large dust particles constantly present in larger or smaller quantities in the Martian atmosphere.   J. R.

A65-18972 #
BRIGHTNESS DISTRIBUTION IN THE MARGINAL ZONE OF MARS [RASPREDELENIE IARKOSTI V KRAEVOI ZONE MARSA].
L. A. Bugaenko, O. I. Bugaenko, I. K. Koval', and A. V. Morozhenko.
IN: PHYSICS OF THE MOON AND PLANETS [FIZIKA LUNY I PLANET].
Edited by I. K. Koval'.
Kiev, Naukova Dumka, 1964, p. 54-57. In Russian.
Presentation of the results of photoelectric observations of Mars by the method of cross sections. The brightness distribution along the visible radius of the planet was traced up to r = 0.97 of the Mars radius. The results, averaged and corrected for tur-bulent vibration of the image and for the dimension of the diaphragm (D = 0".35), are tabulated. It is found that for $\lambda < 390$ m μ, the at-mosphere of Mars possesses a considerable true absorption, while at large wavelengths the main role is attributed to scattering.   J. R.

A65-18974 #
METHOD AND RESULTS OF DETERMINATION OF OPTICAL PARAMETERS OF THE MARTIAN ATMOSPHERE AND SURFACE [METODIKA I RESUL'TATY OPREDELENIIA OPTICHESKIKH PARAMETROV ATMOSFERY I POVERKHNOSTI MARSA].
A. V. Morozhenko and E. G. Ianovitskii.
IN: PHYSICS OF THE MOON AND PLANETS [FIZIKA LUNY I PLANET].
Edited by I. K. Koval'.
Kiev, Naukova Dumka, 1964, p. 81-91. 20 refs. In Russian.
Presentation of a method for determining the optical parameters of the atmosphere and surface of Mars, based on data from absolute photometry. In particular, the method is shown to make possible a rapid and reliable determination of both the optical thickness and the absorbing power of the atmosphere. On the basis of the results obtained, it is concluded that in the range of wavelengths from 450 to 840 mμ, the Martian atmosphere is purely diffusive. Beginning with $\tilde{\lambda} \sim 450$ mμ the true absorption increases with a decrease in wavelength. In the range of wavelengths from 360 to 450 mμ the optical thickness of the Martian atmosphere can vary within very

broad limits, frequently exceeding unity. In the infrared and ultra-violet regions of the spectrum, the albedo of the Martian surface varies much more slowly with wavelength than in the visible region.
J.R.

A65-18975 #
APPROXIMATE SOLUTION OF THE PROBLEM OF DIFFUSE REFLECTION AND TRANSMISSION OF LIGHT BY ATMOSPHERES OF PLANETS FOR AN ARBITRARY DISPERSION COEFFICIENT [PRIBLIZHENNOE RESHENIE ZADACHI O DIFFUZNOM OTRAZHENII I PROPUSKANII SVETA ATMOSFERAMI PLANET PRI PROIZVOL'NOI INDIKATRISE RASSEIANIIA].
E. G. Ianovitskii.
IN: PHYSICS OF THE MOON AND PLANETS [FIZIKA LUNY I PLANET].
Edited by I. K. Koval'.
Kiev, Naukova Dumka, 1964, p. 92-110. 20 refs. In Russian.
Presentation of an approximate solution to the problem of diffuse reflection and transmission by a flat layer of a planetary atmosphere with true absorption. Approximate formulas are derived for the Ambartsumian functions with the simplest nonspherical dispersion coefficient. This curve can be used to calculate the intensity of diffuse-reflected and diffuse-transmitted radiation by the layer, both with and without an isotropically reflecting surface adjoining to the layer. Sobolev's method is used to obtain approximate formulas for the brightness coefficients of the diffuse-reflected and diffuse-transmitted radiation with an arbitrary dispersion coefficient. It is noted that the formulas presented may be used for both the interpretation of observations of planets and for studying the diffusion of radiation in the Earth's atmosphere and in the sea.
J.R.

A65-19314
ACCURACY REQUIRED FOR SPACE VEHICLE RECOVERY TRAJECTORIES [PRECISIONS REQUISES POUR LES TRAJECTOIRES DE RETOUR D'ENGINS SPATIAUX].
L. Moulin (Centre de Formation en Aérodynamique Expérimentale, Rhode-Saint-Genèse, Belgium).
IN: INTERNATIONAL ASTRONAUTICAL CONGRESS, 13TH, VARNA, BULGARIA, SEPTEMBER 1962, PROCEEDINGS. VOLUME 2. [A65-19311 09-30]
Edited by Nicolas Boneff and Irwin Hersey.
Vienna, Springer-Verlag, 1964, p. 523-554. In French.
Analysis of recovery trajectories extending from a given initial orbit to the top of the atmosphere. The propulsion is reduced to an impulse; the trajectories considered lie in the plane of the initial orbit; a spherical nonrotating Earth is the only center of attraction. Analytical expressions are derived for the velocity increment and its orientation at the departure from the initial orbit, first for the case of a circular orbit and then for the general case. Optimization of the fuel consumption is analyzed in two instances: the search for an absolute minimum and rocket braking outside the atmosphere. Expressions are also given for the accuracy requirements on vehicle attitude, velocity increment, and determination of the initial orbit.
(Author) W.M.R.

A65-19485 #
STRUCTURE OF THE TERRESTRIAL HETEROSPHERE [LA STRUCTURE DE L'HETEROSPHERE TERRESTRE].
M. Nicolet (Centre National d'Etudes et de Recherches Aéronautiques, Brussels, Belgium).
(Astronautica Acta, vol. 10, no. 1, 1964, p. 24-34.)
Institut Royal Meteorologique de Belgique, Contributions, no. 96, 1964, p. 24-34. In French.
Discussion of results of observations obtained from satellites and rockets, which leads to consideration of the problem of the heterosphere under new aspects. The thermal balance must first be obtained by introducing into the thermosphere the effect of variable uv solar heating in the course of an eleven-year cycle of activity, and that of the cooling which is basically related to conductive heat transfer. Thus, the photodissociation of molecular oxygen constitutes the essential source of oxygen atoms. Furthermore, gas diffusion in the gravity field keeps the molecular constituents above those normal limits which unite the dissociation balance.

Normal diffusion establishes the predominance of atomic oxygen in the upper thermosphere, and it is concluded that the less-abundant elements in the homosphere end up by dominating the nitrogen and the oxygen, and creating belts of helium and hydrogen, before escaping under one form or another from the exosphere.
F.R.L.

A65-19505 #
BUOYANT PROBES INTO THE VENUS ATMOSPHERE.
F. R. Gross (Goodyear Aerospace Corp., Akron, Ohio).
IN: AIAA UNMANNED SPACECRAFT MEETING, LOS ANGELES, CALIF., MARCH 1-4, 1965 (AIAA PUBLICATION CP-12).
[A65-19498 09-31]
New York, American Institute of Aeronautics and Astronautics, 1965, p. 76-87. 16 refs.
Preliminary study directed toward selecting expandable drag bodies capable of withstanding entry into the Venus atmosphere and remaining in static equilibrium at the higher altitudes to support instruments for the exploration of Venus. The study is based on Kaplan's Venus atmosphere, which is discussed. The payloads considered are limited to those which can be put into a 1000-mi circular orbit around Venus. The payload of a Saturn launch vehicle, then, would be a Voyager-type probe with a detachable instrument capsule. The capsule would enter and stay for an extended time period in the Venus atmosphere and send scientific information back to the Voyager, which would then relay the information back to Earth. The entry into Venus atmosphere is considered. The necessary instrumentation would be supported by a Ballute-type balloon capable of entry into, and of static equilibrium within, the Venus atmosphere. The Ballute design, construction, and operation are discussed. Scientific experiments possible with the Voyager probe are noted.
M.L.

A65-19518 #
THE AUTOMATED BIOLOGICAL LABORATORY - THE SCIENTIFIC AND ENGINEERING OBJECTIVES.
Temple W. Neumann (Philco Corp., Aeronutronic Div., Newport Beach, Calif.).
IN: AIAA UNMANNED SPACECRAFT MEETING, LOS ANGELES, CALIF., MARCH 1-4, 1965 (AIAA PUBLICATION CP-12).
[A65-19498 09-31]
New York, American Institute of Aeronautics and Astronautics, 1965, p. 224-229.
Review of the present technological capability of the US space program of exploring the planets, particularly Mars, for extraterrestrial life. Specifically, the Automated Biological Laboratory (ABL), a planetary landing payload concept currently under study by the Aeronutronic Division, Philco Corp., under contract to the Office of Bioscience Programs, NASA, is reviewed. The scientific objectives, techniques for the detection and classification of extraterrestrial life, and the system problems are discussed. The most difficult single problem in the design of the ABL is identified as the selection of the most meaningful characteristics of life. The importance of the program from the philosophical, scientific, and engineering viewpoints is considered to be apparent. An integrated ABL is suggested as the optimum approach to such a search. It is concluded that no fundamental technological barrier appears to exist that would prevent the U.S. from accomplishing this mission in the early 1970's.
M.L.

A65-19520 #
PLANETARY ATMOSPHERIC DETERMINATION UTILIZING A SEMIPASSIVE PROBE.
Frank S. Holman and Haim Kennet (Boeing Co., Aero-Space Div., Seattle, Wash.).
IN: AIAA UNMANNED SPACECRAFT MEETING, LOS ANGELES, CALIF., MARCH 1-4, 1965 (AIAA PUBLICATION CP-12).
[A65-19498 09-31]
New York, American Institute of Aeronautics and Astronautics, 1965, p. 236-245. 9 refs.
Presentation of an experiment to provide highly accurate knowledge on the density/altitude and pressure/altitude profiles of planetary atmospheres, notably those of Mars and Venus. The experiment is to consist of a small, lightweight spherical probe

injected into the planetary atmosphere either from a flyby space-
craft prior to planetary encounter or from a planetary orbiter prior
to orbit injection. Information on the probe's entry flight-path angle
and its velocity history before and after communications blackout
is to be obtained through a two-way doppler measurement by the
Deep Space Instrumentation Facility (DSIF), Aero-Space Div.,
Boeing Co. To demonstrate the concept's validity, the application
of such an experiment to determining the atmosphere of Mars is
presented. The mission profile of the probe, as well as the current
and future capability of the DSIF to provide the required data, is
discussed first. The techniques for converting the doppler data
into knowledge of the Martian atmospheric density and pressure
profiles are then developed without a priori assumptions about the
atmosphere. It is shown that with Earth-based astronomical ob-
servations, augmented by theoretical climatology considerations,
the analysis can be simplified without loss of accuracy. Using
simulated DSIF data furnished by the NASA Ames Research Center,
both generalized and simplified analysis techniques are applied.
The density profiles thus predicted are shown to be in remarkable
agreement with those used by Ames in generating the simulated
data. A conceptual design suitable for incorporation into a modified
Mariner spacecraft is presented. (Author) M. L.

A65-19668
OPTICAL PROPERTIES OF THE MARTIAN ATMOSPHERE IN THE
ULTRAVIOLET.
V. I. Garazha and E. G. Ianovitskii (Khar'kovskaia Astronomi-
cheskaia Observatoriia, Kharkov; Akademiia Nauk Ukrainskoi SSR,
Glavnaia Astronomicheskaia Observatoriia, Kiev, Ukrainian SSR).
(Astronomicheskii Zhurnal, vol. 41, Sept.-Oct. 1964, p. 942-950.)
Soviet Astronomy, vol. 8, Mar.-Apr. 1965, p. 754-760. 21 refs.
Translation.
Proof that the optical thickness of the atmosphere of Mars in
the $\bar{\lambda}$ = 360 mμ region of the spectrum was appreciably greater than
unity during the great 1956 opposition. Suggestion is made that the
"UV layer" of the atmosphere of Mars consists of a gas-aerosol
mixture. The particle albedo of the mixture is 0.50 in the event of
single scattering. The indicatrix of light scattering in the spectrum
region and the mean aerosol particle radius are determined using
the Rocard theory to interpret atmospheric indicatrices. The
concentration of aerosol particles in the UV layer is found to be
very high. V. Z.

A65-19676 #
A MODEL OF VENUS WITH A "COLD" ABSORBING ATMO-
SPHERE [O MODELI VENERY S "KHOLODNOI" POGLOSHCHAIU-
SHCHEI ATMOSFEROI].
A. D. Kuz'min (Akademiia Nauk SSSR, Fizicheskii Institut, Moscow,
USSR).
Radiofizika, vol. 7, no. 6, 1964, p. 1021-1031. 22 refs. In Russian.
Study of the possibility of interpreting the observed spectrum
of Venus radio emission in the centimeter and millimeter wavebands
as absorption into the atmospheric aerosol of the planet. It is
shown that the steep slope of the millimeter band of the spectrum
can be explained by the absorption into a liquid aerosol with a tem-
perature of about 300°K and containing 0.2 to 0.3 gcm^{-2} of the
polar liquid with a relaxation time of 3.5×10^{-12} sec. It is shown
that the model of atmosphere yielding such a spectrum is absolute-
ly nontransparent in the infrared and optical regions of the spec-
trum. Therefore a direct solar radiation cannot be the source of
surface heating of the planet. Surface heating by the inner heat of
the planet is considered, and the required heat flux is estimated.
The possibility is indicated of explaining the observed decrease in
the brightness temperature of Venus in the decimeter waveband
as absorption into the relatively cold Venus ionosphere. J. R.

A65-19853 #
SOME PROPERTIES OF THE ATMOSPHERE OF MARS [NEKE
OSOBINE MARSOVE ATMOSFERE].
Dragoslav Eksinger.
Vasiona, vol. 12, no. 1, 1964, p. 4-6. In Croatian.
Brief discussion of some of the basic properties of the atmo-
sphere of the planet Mars which distinguish it from the atmosphere
of the Earth. In particular, circulation of air masses in the
Martian atmosphere, water content in the inert air masses, and
distribution of thermal flows are considered. J. R.

A65-19902
MARS - THE ORIGIN OF THE 3.58- AND 3.69-MICRON MINIMA
IN THE INFRARED SPECTRA.
D. G. Rea, B. T. O'Leary (California, University, Space Sciences
Laboratory, Berkeley, Calif.), and W. M. Sinton (Lowell Obser-
vatory, Flagstaff, Ariz.).
Science, vol. 147, Mar. 12, 1965, p. 1286-1288. 12 refs.
Contract No. NASr 220.
Analysis of the 3- to 4-μ spectra of Mars recorded in 1958
with the 200-in. Hale telescope, in order to determine if the mini-
ma at 3.58 and 3.69 μ are due to terrestrial HDO molecules, rather
than to substances on Mars as previously indicated. Solar spectra,
together with water-vapor abundances derived from radiosonde
flights, obtained during the observing period are studied. There
appears to be a correlation between the intensities of the 3.58- and
3.69-μ features and the amount of terrestrial water vapor in the
optical path. Thus, the data considered are no evidence for the
presence on Mars of substances absorbing at these wavelengths.
P. K.

A65-20563 #
AN ANALYTIC SOLUTION FOR ENTRY INTO PLANETARY ATMO-
SPHERES.
S. J. Citron and T. C. Meir (Purdue University, School of Aero-
nautical and Engineering Sciences, Lafayette, Ind.).
AIAA Journal, vol. 3, Mar. 1965, p. 470-475. 15 refs.
Derivation of approximate closed-form solutions for inclination
angle and density or altitude as a function of velocity, for a body
entering a planetary atmosphere. The method of solution used
assumes that the atmospheric density may be expanded in a power
series in terms of the logarithm of the velocity. Termination of
the series after the first three terms is shown to be equivalent to a
result obtained by Loh on the basis of observations that a certain
combination of the entry variables may be considered constant.
The approximate solution obtained is compared with the exact
solution and with other approximate solutions obtained by Loh and
Allen and Eggers, over wide regions of lift-to-drag ratio, entry
velocity, and entry-inclination angle. Good agreement is found
over all regions except those corresponding to certain skipping-
type trajectories. For this critical case, the solution of Loh is also
inaccurate. It is stated that, in general, the solution obtained
yields the same accuracy as the second-order theory of Loh,
although it is somewhat simpler to apply. (Author) M. M.

A65-20633
A RE-EVALUATION OF W. H. WRIGHT'S PLATES OF THE 1924
AND 1926 OPPOSITIONS OF MARS.
R. A. Wells (London, University, University College, Dept. of
Physics, London, England).
Planetary and Space Science, vol. 13, Mar. 1965, p. 261-263. 12
refs.
Grant No. NsG 101-61.
Re-examination of Wright's original plates of the 1924 and 1926
oppositions of Mars, from which he first deduced that Mars photo-
graphed on IR has a smaller diameter than when photographed on
UV plates. The plates are analyzed by both a micrometer measur-
ing engine and a microphotometer. A wide difference found between
the measurements by the two methods is explained on the basis that
the microphotometer picked up faint extensions of the atmosphere
that the eye could not distinguish. The diameter of the Martian
surface is deduced to be 6682 km. Problems in the photographic
determination of planetary diameters are discussed, including
those arising from the optical system and tracking and from the
photographic plates. P. K.

A65-21854
COMPARISONS OF LABORATORY AND PLANETARY SPECTRA.
II - THE SPECTRUM OF JUPITER FROM 9700 TO 11200 $\overset{\circ}{A}$.

Tobias Owen (Illinois Institute of Technology, Research Institute, Astrosciences Center, Chicago, Ill.; Arizona, University, Lunar and Planetary Laboratory, Tucson, Ariz.).
Astrophysical Journal, vol. 141, Feb. 15, 1965, p. 444-456. 33 refs.
Contract No. NRO 46-79L.
Comparison of absorption spectra of several gases with the spectrum of Jupiter in the region 9700-11200 Å. All nonsolar absorptions occurring in this region of the planet's spectrum are identified as due to NH_3 or CH_4. Upper limits are set on the abundances of HCN and C_2H_2, and previous limits on CH_3D, CH_3NH_2, and the D/H ratio are revised. The 3_{ν_3} band of CH_4 at 11057 Å in the spectrum of Jupiter is analyzed theoretically and empirically to derive a mean atmospheric temperature of $200 \pm 25°K$. This result appears consistent with a model of the Jovian cloud deck which requires the presence of considerable vertical structure. (Author) D.H.

A65-21855
DECAMETER-WAVELENGTH OBSERVATIONS OF JUPITER - THE APPARITIONS OF 1961 AND 1962.
Alex G. Smith, G.R. Lebo, N.F. Six, Jr., T.D. Carr (Florida, University, Dept. of Physics and Astronomy, Gainesville, Fla.), Heinz Bollhagen, Jorge May, and Jorge Levy (Chile, University, Maipú Radioastronomical Observatory, Maipú, Chile).
Astrophysical Journal, vol. 141, Feb. 15, 1965, p. 457-477. 26 refs.
Army-Navy-NSF-supported research.
Final reduction of extensive observations of Jupiter conducted during 1961 and 1962 in the radio-frequency range 5 to 31 Mc. Both probability-of-emission and intensity studies have been made of the several decametric "sources." It appears that a change in the apparent rate of rotation of the sources occurred in 1960. Both the overall Jovian activity and the apparent widths of the sources have increased as the solar cycle declined, although the gross source geometry remains much the same as in previous years. Television techniques have been used in a search for optical activity correlated with the Jovian outbursts. Venus and Mars have shown no detectable decametric activity, while Saturn remains, as before, a dubious source. (Author) D.H.

A65-22097 #
A QUANTITATIVE MEASUREMENT OF WATER-VAPOR IN THE ATMOSPHERE OF VENUS.
Mark Bottema, William Plummer, and John Strong (Johns Hopkins University, Baltimore, Md.).
(Symposium sur les Observations Astronomiques Faites à Bord de Vehicules Spatiaux, 23rd, Liège, Belgium, Aug. 17-20, 1964.)
Annales d'Astrophysique, vol. 28, Jan.-Feb. 1965, p. 225-228.
Contract No. AF 19(628)-202.
Description of the method of observing Venus water-vapor absorption in the 1.13-μ band. Certain aspects of the data-recording system, the data reduction, and the interpretation of the results are discussed in the light of present knowledge of the atmosphere of Venus. A.B.K.

A65-22098 #
SPACECRAFT OBSERVATION OF VENUS INFRA-RED LIMB-DARKENING.
Carl Sagan (Harvard University; Smithsonian Institution, Smithsonian Astrophysical Observatory, Cambridge, Mass.) and James B. Pollack (Harvard University, Harvard College Observatory, Cambridge, Mass.).
(Symposium sur les Observations Astronomiques Faites à Bord de Vehicules Spatiaux, 23rd, Liège, Belgium, Aug. 17-20, 1964.)
Annales d'Astrophysique, vol. 28, Jan.-Feb. 1965, p. 229-233; Discussion, p. 233.
Comparison of the limb-darkening laws predicted for several models of the atmosphere and clouds of Venus with limb-darkening observations in the 8- to 13-μ interval made from the ground and from Mariner II. Model A attributes the limb-darkening to pure molecular absorption by the atmosphere above the Cytherean cloud layer; Model B attributes it to multiple scattering by cloud particles of arbitrary albedo and altitude distribution. In each model, the temperature regime is considered to be specified alternatively by convective and radiative equilibrium. In Model A, limb-darkening

arises from the increase of temperature with atmospheric depth. In Model B, both the (T -ϒ) relation and the dependence of emissivity on the angle of emergence contribute to the limb-darkening. Each model can be made to agree with observation, with an appropriate specification of atmospheric and cloud parameters. With the angular resolution available from the vicinity of the Earth, a discrimination among these models is difficult to achieve. But a Venus fly-by or orbiter performing only somewhat better than Mariner II can potentially determine uniquely the cause of the limb-darkening and provide significant new information on the structure and composition of the atmosphere and clouds of Venus. (Author) A.B.K.

A65-22120 #
BIOLOGICAL PRECURSOR MISSIONS TO MARS.
Temple W. Neumann (Philco Corp., Aeronutronic Div., Newport Beach, Calif.).
American Institute of Aeronautics and Astronautics, Air Force Logistics Command, Aeronautical Systems Division, Support for Manned Flight Conference, Dayton, Ohio, Apr. 21-23, 1965, Paper 65-249. 15 p. 22 refs.
Members, $0.50; nonmembers, $1.00.
Brief review of studies of manned missions to Mars performed to date by NASA, and demonstration, by several examples, of the dependence of such missions on our knowledge of the physical environment of Mars. A knowledge of the biological parameters on Mars is shown to be of equal or greater importance. The evidence for life on Mars is reviewed. Effects which such life can have on the factors of crew contamination during surface operations, air lock, and decontamination operations, material degradation, and spacecraft and Earth back-contamination by returned crew members, equipment, and samples, are specifically reviewed. Possible advantages of indigenous life forms in support of future manned operations on Mars are also pointed out. The importance of early biological precursor missions to obtain the required data is apparent from these possible interactions. Essential differences are shown to exist, however, between procedures used for space physics experimentation and those required to obtain meaningful biological data. It is demonstrated that these differences lead to the concepts being employed in an automated biological laboratory (ABL) currently under study. (Author) M.M.

A65-22135
LUNAR AND PLANETARY ENVIRONMENTS.
John M. Eggleston, Dallas E. Evans, and John W. Harris (NASA, Manned Spacecraft Center, Houston, Tex.).
IN: TOWARDS DEEPER SPACE PENETRATION; PROCEEDINGS OF AN AAS SYMPOSIUM HELD AS PART OF 131ST MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, MONTREAL, CANADA, DECEMBER 29, 1964 (AAS Science and Technology Series. Volume 2). [A65-22134 12-30]
Edited by E. R. Van Driest.
North Hollywood, Western Periodicals Co., 1964, p. 7-53. 35 refs.
Description of the lunar and planetary "natural" environments currently used by the Manned Spacecraft Center of NASA for manned mission planning and design. A natural environment is defined as that environment which is thought to exist without the induced effects of the spacecraft and sensors. Although there are many theories and interpretations of the data, with consequent uncertainties, only a few of these affect spacecraft and mission design. The lunar natural environment is covered in terms of (1) the lunar response throughout the electromagnetic spectrum, (2) the topography and engineering properties, (3) the atmosphere, and (4) the external radiation and meteoroid environment. The planetary environment is covered by first separating the planets into categories and considering primarily those which are of interest to manned missions. Of these, Mars appears to be most interesting, and primary attention is paid to the natural environment of this planet. (Author) F.R.L.

A65-22205
11-CM OBSERVATIONS OF THE TEMPERATURE OF MERCURY.
K. I. Kellermann (Commonwealth Scientific and Industrial Research Organization, Radiophysics Laboratory, Sydney, Australia).
Nature, vol. 205, Mar. 13, 1965, p. 1091, 1092. 6 refs.

Determination of the temperature distribution at the surface
of Mercury, based on measurements of the mean disk temperature
over a wide range of phase angles as the planet moves in its orbit
around the Sun. Observations were made on ten separate days
during May and June 1964 at a wavelength of 11 cm for planetocentric
phase angles Θ from 29° to 149° (Θ is the angle between the Sun
and the Earth as seen from Mercury). The observations were made
by scanning back and forth in declination over a range of about 45
min of arc approximately centered on the declination of Mercury.
It is found that the surface temperature does not exhibit the strong
dependence on phase angle that it was expected to. In particular,
the observations at large phase angles, where only 10 to 15% of the
visible disk was illuminated by the Sun, indicate a temperature of
about $250^\circ K$ on the dark hemisphere. This, taken with other con-
siderations, seems to indicate that atmospheric convection plays
an important role in determining the temperature distribution on
the surface of Mercury. P.K.

A65-22598

SOLAR-WIND MEASUREMENTS NEAR VENUS.
Marcia Neugebauer and Conway W. Snyder (California Institute of
Technology, Jet Propulsion Laboratory, Pasadena, Calif.).
Journal of Geophysical Research, vol. 70, Apr. 1, 1965, p. 1587-
1591. 18 refs.
Determination of the velocity, temperature, and density of the
protons in the solar wind for the period when Mariner 2 was near
Venus. From these data, it is concluded that: (1) Mariner 2 never
penetrated any magnetosphere associated with Venus, (2) Mariner 2
was probably also outside any shock front associated with the super-
sonic motion of the solar wind past Venus; (3) the solar-wind
intensity was not especially great during the time of Venus en-
counter, and (4) any shock wave surrounding Venus was probably
closer than about 25,000 km to the center of the planet at the sub-
solar point. (Author) D.H.

A65-23098

A DETECTOR FOR THE ARGON ABUNDANCE IN THE MARTIAN
ATMOSPHERE.
F. B. Harrison, W. Bernstein, and J. L. Vogl (Space Technology
Laboratories, Inc., Redondo Beach, Calif.).
(Nuclear Science Symposium, 11th, Instrumentation in Space and
Laboratory, Philadelphia, Pa., Oct. 28-30, 1964.)
IEEE Transactions on Nuclear Science, vol. NS-12, Feb. 1965,
p. 103.
Description of an instrument consisting of a cylindrical ioniza-
tion chamber containing an Fe 55 X-ray source, to be used aboard
a capsule descending through the Martian atmosphere to detect the
atmospheric argon content. The atmosphere of Mars is assumed to
consist of a mixture of argon, nitrogen, and carbon dioxide with
other gases appearing only in trace amounts. A capsule descending
through the Martian atmosphere, containing instruments to measure
the pressure, density, and temperature, would make possible the
determination of the total pressure and mean molecular weight.
One more measurement would then be necessary to determine the
partial pressures of the three gases. This measurement could be
made with an ionization chamber containing an Fe 55 X-ray source.
In such a chamber the current would be linearly related to the
argon content of the atmosphere. (Author) D.P.F.

A65-23429

RADIO PATH FORMULAE FOR RADIOASTRONOMY AND ASTRO-
NAUTICS.
E. Chvojková (Czechoslovak Academy of Sciences, Astronomical
Institute, Prague, Czechoslovakia).
Astronomical Institutes of Czechoslovakia, Bulletin, vol. 16,
no. 1, 1965, p. 5-10. 9 refs.
Summary of the previously derived radio-path formulas for
astronomical and astronautical purposes. The formulas are first
applied to planetary ionospheres and stellar atmospheres. As
long as the ionized regions possess a spherical symmetry, the ray
path is easily determined by a quasi-conic equation since the whole
region can be divided into thinner spherical layers in which the
electron-density variation is defined in terms of the radius of curva-
ture. The applicability of the electron-density equation and the
quasi-conic equation to planetary ionospheres - in spite of their
importance in astronautics - is mentioned only in brief because it

has been described in detail in a number of other papers. The
electron-density curves, however, show a singularity for $r_x \equiv 0$,
and, since stellar atmospheres also have a maximum of electron
density coinciding with the center of symmetry, this kind of radio
propagation is treated predominantly. Attention is also paid to the
separation of rather irregular ionized layers or clouds in order to
obtain a precise ray path. (Author) D.H.

A65-23486

SURVIVAL AND GROWTH OF TERRESTRIAL MICROORGANISMS
IN AMMONIA-RICH ATMOSPHERES.
S. M. Siegel and C. Giumarro (Union Carbide Corp., Research
Institute, Tarrytown, N.Y.).
Icarus, vol. 4, Apr. 1965, p. 37-40. 9 refs.
Contract No. NASw-767.
Demonstration that various bacteria and ascomycetes have
grown on specimens of Euphorbia xylophylloides and other xero-
phytes after two months in atmospheres containing NH_3 with CH_4,
H_2, or air. NH_3 levels of at least 50,000 ppm far exceeded con-
ventional upper safe limits for human toxicity. Extreme per-
formance was shown by a stress-adapted Penicillium brevi-com-
pactum which grew slowly in 95% NH_3/5% CH_4. It is considered
that these observations are significant with reference to the origin
and current existence of microbial life on Jupiter.
(Author) F.R.L.

A65-23487

INFRARED REFLECTIVITY OF $Fe_2O_3 \cdot nH_2O$ - INFLUENCE ON
MARTIAN REFLECTION SPECTRA.
W. A. Hovis, Jr. (NASA, Goddard Space Flight Center, Greenbelt,
Md.).
Icarus, vol. 4, Apr. 1965, p. 41, 42.
Measurement of the IR reflectivity of limonite and $Fe_2O_3 \cdot nH_2O$
from 1 to 5 μ. A strong reflection minimum due to water of hydra-
tion is shown. The influence of the measured reflectivities on
Martian spectra is discussed. It is considered possible that, by
combining measurements of water vapor in the atmosphere made in
other spectral regions with measurements in the 2 to 4 μ region an
estimate of the degree of hydration of the Martian surface may be
made. F.R.L.

A65-23491

AN EXPLANATION OF KOZYREV'S HYDROGEN EMISSION LINES
IN THE SPECTRUM OF MERCURY.
Hyron Spinrad and Paul W. Hodge (California, University, Berkeley
Astronomical Dept., Berkeley, Calif.).
Icarus, vol. 4, Apr. 1965, p. 105-108.
Examination of data obtained from several high-resolution near-
IR spectrograms of Mercury taken through the 120-in. coudé of the
Lick observatory. It was found possible to place quantitative upper
limits on possible gaseous constituents of the Mercurian atmosphere.
A microphotometer tracing is presented which was made of the
spectrum. A strong IR Ca II line $\lambda 8542$ is shown, and double ab-
sorption peaks are clear. If the significance of a sky component
to the Mercury spectrum were not realized, the hump between the
two absorption lines might well suggest an emission core feature,
and therefore this spurious core "emission" between the two absorp-
tion components of all strong Fraunhofer lines may be the source
of Kozyrev's claim of an accreted atomic hydrogen atmosphere.
F.R.L.

A65-23521

OZONE AND CARBON DIOXIDE HEATING IN THE MARTIAN AT-
MOSPHERE.
C. Prabhakara (NASA, Goddard Space Flight Center, Goddard
Institute for Space Studies, New York, N.Y.) and Joseph S. Hogan,
Jr. (New York University, New York, N.Y.).
Journal of the Atmospheric Sciences, vol. 22, Mar. 1965, p. 97-109.
40 refs.
Examination of the radiative equilibrium temperature structure
of the atmosphere of the planet Mars. The absorption of solar ener-
gy in the UV and visible by O_2 and O_3 and in the near IR by CO_2 is
included in the calculation of atmospheric heating. The transmission

functions of CO_2 are theoretically calculated making use of a "statistical" model for band absorption. These transmission functions are then used to evaluate the absorption of solar energy in the near IR and to investigate the radiative transfer in the far IR. The theoretical band parameters involving the line intensity and the mean ratio of line half-width to line spacing are derived using the transmittance tables of CO_2 presented by Stull, Wyatt and Plass. The basic photochemical theory of O_3 production is used to determine a vertical O_3 distribution consistent with the radiative equilibrium temperature structure. The equation of radiative transfer is numerically integrated, avoiding the empirical relationships commonly involved in the pressure dependence of CO_2 absorption. The IR flux transmittance is also calculated without any simplifying assumptions. Radiative equilibrium temperatures are calculated from the surface of the planet to the 100-km level. For surface temperatures ranging from $230°$ to $270°K$, surface pressures from 10 to 50 mb, and CO_2 amounts from 40 to 70 m atm, the "tropopause" is found at levels below 10 km. Within these limits of surface temperature and pressure and CO_2 amounts, the temperature above the tropopause steadily decreases toward a value of $\sim 155°K$ in the upper layers. The results indicate that no temperature maximum is produced by the absorption of solar energy in the UV by O_3 or in the near IR by CO_2 in the Martian atmosphere. The maximum O_3 number density is found at the surface of Mars with a gradual decrease upward. The total amount of O_3 present is about one-tenth of the amount found in the Earth's atmosphere (~ 0.3 cm atm). The total UV energy absorbed in the Martian atmosphere by O_2 and O_3 is comparable to the near IR energy absorbed by CO_2. However, the vertical distribution of absorbed energy shows that, below ~ 30 km, O_2 and O_3 absorption is comparable to CO_2 absorption, while above this level CO_2 absorption becomes considerably larger. (Author) A.B.K.

A65-23918
THE AERODYNAMIC PROBLEMS OF THE HYPERSONIC FLIGHT OF SPACE PROBES THROUGH PLANETARY ATMOSPHERES [DIE AERODYNAMISCHEN PROBLEME DES HYPERSONISCHEN FLUGES VON RAUMSONDEN DURCH PLANETARISCHE ATMOSPHÄREN].
Ernst Adams (Deutsche Versuchsanstalt für Luft- und Raumfahrt, Institut für angewandte Mathematik und Mechanik, Freiburg im Breisgau, West Germany).
(Deutsche Gesellschaft für Raketentechnik und Raumfahrtforschung, and Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Annual Meeting, Berlin, West Germany, Sept. 1964.)
Raumfahrtforschung, vol. 9, Apr.-June 1965, p. 66-75. 36 refs.
In German.
A discussion of the flight corridor through an atmosphere, which is bounded on the one hand by the deceleration factor in the range of flight due to the effect of lift and on the other by small aerodynamic drag, based on the two-body problem in celestial mechanics. Thermochemical effects and the effects of more rarefied atmospheres in the flow field around the vehicle are discussed, and the methods for calculating pressure distribution are given. After a brief qualitative review of the causes of aerodynamic heating, quantitative estimates of its order of magnitude are presented. The conduction of heat by convection and by radiation is considered, and numerical data on heat flow are included. Finally, evaporation cooling and thermal protection are discussed. D.P.F.

A65-24615
EXPLOSIONS IN RAREFIED ATMOSPHERES.
G. W. Stuart (General Dynamics Corp., General Atomic Div., John Jay Hopkins Laboratory for Pure and Applied Science, San Diego, Calif.).
Physics of Fluids, vol. 8, Apr. 1965, p. 603-606. 5 refs.
An investigation of explosions in cold, homogeneous atmospheres, in which, initially, the mean free path of an explosive product atom through the atmosphere is much longer than the dimension of the expanding material. On the basis that a uniform expansion persists for all time, a snowplow model is derived from the virial theorem and is used to describe the expansion. To illustrate the method, a chemical explosion in the Earth's atmosphere at 150 km is analyzed. (Author) D.P.F.

A65-24803 #
THE THEORY OF RADIO EMISSION OF VENUS [K TEORII RADIOIZLUCHENIIA VENERY].
A. D. Kuz'min (Akademiia Nauk SSSR, Fizicheskii Institut, Moscow, USSR).
Radiofizika, vol. 8, no. 1, 1965, p. 7-18. 13 refs. In Russian.
Derivation of analytical expressions relating the brightness temperature of the radio emission of the planet surrounded by an absorbing atmosphere to the physical parameters of its surface and atmosphere. Numerical solutions are obtained for the special cases of absorption by the entire thickness of the atmosphere and absorption in homogeneous and parabolic layers. These solutions are used in interpreting the results of radio-astronomical measurements of Venus. (Author) A.B.K.

A65-25020 #
OZONE DISTRIBUTION IN THE ATMOSPHERE OF MARS.
F. F. Marmo, Shardanand, and Peter Warneck (GCA Corp., Bedford, Mass.).
Journal of Geophysical Research, vol. 70, May 1, 1965, p. 2270-2272. 12 refs.
Analytical attempt to reconcile the conflict between the results of Marmo and Warneck (1961), who found a monotonic increase in ozone concentration with decreasing altitude and those of Paetzold (1963), who suggested the existence of an ozone concentration peak at an altitude of about 40 km. There is agreement that the basic photochemical reactions involved in the atmosphere of Mars are: (1) $O_2 + h\nu \rightarrow O + O$, $\lambda \leq 2400$ Å; (2) $O + O_2 + M \rightarrow O_3 + M$; (3) $O + O_3 \rightarrow O_2 + O_2$; (4) $O_3 + h\nu \rightarrow O_2 + O$, $\lambda \leq 3000$ Å; (5) $O + O + M \rightarrow O_2 + M$; (6) $CO_2 + h\nu \rightarrow CO + O$, $\lambda \leq 1750$ Å; and (7) $CO + O \rightarrow CO_2$. The overriding discrepancy factor is seen to be that Marmo and Warneck included Eq. (5) which Paetzold ignored. It is concluded that the existence of an ozone layer in the atmosphere of Mars can be denied. W.M.R.

A65-25099 #
CHAMBER SIMULATING MARTIAN CONDITIONS FOR MICRO-BIOLOGICAL INVESTIGATIONS [KAMERA, IMITIRUIUSHCHAIA USLOVIIA MARSA, DLIA MIKROBIOLOGICHESKIKH ISSLEDOVANII].
A. I. Zhukova and I. I. Kondrat'ev.
Kosmicheskie Issledovaniia, vol. 3, Mar.-Apr. 1965, p. 330-333. 6 refs. In Russian.
Description of a chamber (100 x 150 x 180 cm) and the electrical circuit used to simulate the environment on Mars (temperature drop from -30 to -60°C; composition of the atmosphere 95.5% N, 0.25% CO_2, 0.25% Ar) with the exception of the gravitational, magnetic-field, and charged-particle-radiation effects. Preliminary observations of the growth of various cultures of fungi and bacteria(Aspergillus niger, Mucor plumbeus, Strain 1339, Micrococcus aurantiacus, Bacillus subtilis, etc.) in the chamber are reported. W.M.R.

A65-25226
SPECTROSCOPIC OBSERVATIONS OF MERCURY.
Hyron Spinrad, George B. Field, and Paul W. Hodge (California, University, Berkeley Astronomical Dept., Berkeley, Calif.).
Astrophysical Journal, vol. 141, Apr. 1, 1965, p. 1155-1160. 27 refs.
Review of evidence for a Mercurian atmosphere. New high-dispersion spectra of the planet Mercury in the near-infrared make it possible to place upper limits on the abundances of CO_2 (< 57 meter-atmospheres), O_2 (< 1 meter-atmosphere), and H_2O (< 30 μ precipitable). The strength of the 1.6-μ absorption band of CO_2 found by Moroz can be explained only if Mercury possesses a considerable atmosphere ($P_s > 3.3$ mb) which can pressure-broaden that band. While this lower limit and the obtained upper limit are marginally compatible with a pure CO_2 atmosphere of about 4-mb surface pressure, such an atmosphere would be accompanied by a Rayleigh scattering which would lead to a polarization six times larger than the amount detected by Dollfus. Admixture of other constituents would be consistent with both spectroscopic observations, and argon in particular would give the smallest discrepancy with Dollfus' polarization observations.

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The relationship of the pressure estimates obtained to the requirements of the theory which attributes surface features to meteoritic erosion are discussed; it is considered possible that the tenuous atmosphere of Mercury may be time-variable.   (Author) W. M. R.

A65-25228
THE ATMOSPHERE OF VENUS NEAR HER CLOUD TOPS.
Joseph W. Chamberlain (Kitt Peak National Observatory, Tucson, Ariz.).
Astrophysical Journal, vol. 141, Apr. 1, 1965, p. 1184-1205.
67 refs.
    Theory of line formation and some conclusions concerning Venus' atmospheric structure and composition near the top of the cloud cover. It is argued that the absorption bands of CO_2 are produced through multiple scatterings in an optically thick atmosphere and that, consequently, current knowledge of the Cytherean atmosphere is much less precise than is commonly believed. The visual data are reviewed to obtain an estimate of the properties of the cloud particles. Then, thermal-infrared observations are used to derive some idea of the temperature T and its variation with optical depth τ in the cloud; the degree of uncertainty in these parameters is considerable, but it is concluded that the cloud tops are almost certainly cooler than the region where CO_2 absorption occurs. From the $T(\tau)$ dependence combined with the rotational temperature of carbon dioxide, the mean depth $\langle\tau\rangle$ of band formation is deduced. The radiative-transfer theory of line formation is used to relate $\langle\tau\rangle$ to the albedo $\tilde\omega$ for single scattering. The CO_2 equivalent widths and the line profiles are discussed as a means of deriving the amount of collisional broadening and thence the CO_2/total-gas ratio. Spinrad's important conclusion that carbon dioxide is a minor constituent of the Venusian atmosphere is confirmed. For the phase variation of band strength, an error in an earlier paper is corrected, and it is shown that for weak bands the temperature should change very little with phase. Taking Spinrad's data literally, it is concluded that the near-infrared CO_2 bands are formed mostly within the first scale height (about 8 km) below the cloud tops. Kuiper's conclusion that the carbon and oxygen isotopes are in about the same ratios as on Earth is reaffirmed.
W. M. R.

A65-25632 #
RADIO EMISSIONS FROM THE PLANET JUPITER.
D. McNally (London, University, Observatory, Mill Hill, Middx., England).
Science Progress, vol. 53, Apr. 1965, p. 257-262.
    Results of the detection of radio emission from Jupiter. It is considered that the radiation is nonthermal in character. It has been suggested that Jupiter has a magnetosphere similar to that possessed by the Earth, with belts of trapped charged particles similar to the Van Allen belts; with this assumption, it is possible to explain why the decametric radiation is confined to narrow beams.   F. R. L.

A65-25694 #
PHOTOGRAPHIC POLARIMETRY OF VENUS [FOTOGRAFICHE-SKAIA POLIARIMETRIIA VENERY].
V. A. Gagen-Torn.
Leningradskii Gosudarstvennyi Universitet, Astronomicheskaia Observatoriia, Trudy, vol. 21, 1964, p. 95-98. In Russian.
    Investigation of the distribution of polarization over the Cytherean disk for phase angles 52.5 and 53°.5. The degree of polarization is found to increase with distance from the center of the planet. The plane of vibration is seen to coincide with the intensity equator.
(Author) W. M. R.

A65-26040
THE BLUE HAZE OF MARS.
A. Palm and B. Basu (California, University, Space Sciences Laboratory, Berkeley, Calif.).
Icarus, vol. 4, May 1965, p. 111-118. 24 refs.
Grant No. NsG 243-62.
    Investigation of the extent of blue clearings as a function of the number of the meteor showers intersecting the orbit of Mars at 10° intervals of heliocentric longitude. A rank correlation method has been employed. The analysis indicates a small but statistically significant negative correlation between the extent of blue clearing and

meteor shower activity. This result, combined with the optical properties of the Martian atmosphere and the close resemblance between the characteristics of the blue haze and those of the terrestrial noctilucent clouds, suggests that variable amounts of interplanetary dust are suspended in the Martian atmosphere and that the occasional clearings of the blue haze are caused by a diminishing influx of these dust particles.   (Author) D.P.F.

A65-26042
OBSERVATIONS OF JUPITER'S RADIO SPECTRUM AND POLARIZATION IN THE RANGE FROM 6 CM TO 100 CM.
J. A. Roberts and M. M. Komesaroff (Commonwealth Scientific and Industrial Research Organization, Radiophysics Laboratory, Sydney, Australia).
Icarus, vol. 4, May 1965, p. 127-156. 36 refs.
    Data relative to an extensive series of complete determinations of the linear polarization of Jupiter's radio emission at wavelengths of 6, 10, 11, 21, 74, and 100 cm. A search for circular polarization at a wavelength of 31 cm is reported. Recordings of a lunar occultation of the source are also given. The rocking of the plane of polarization with rotation of the planet is shown to be asymmetric in form, probably reflecting some asymmetry in the radiation belt. The beaming of the radiation is used to infer the pitch angle distribution of the electrons in the belt. The distribution appears to change with energy, relatively more of the higher-energy electrons being in very flat helices. The flux density of both the polarized and unpolarized nonthermal radiation is shown to be essentially independent of wavelength over the range from 6 to 74 cm.   (Author) D.P.F.

A65-26212 #
PRESSURE AND CO_2 CONTENT OF THE MARTIAN ATMOSPHERE - A CRITICAL DISCUSSION.
Joseph W. Chamberlain and Donald M. Hunten (Kitt Peak National Observatory, Tucson, Ariz.).
Reviews of Geophysics, vol. 3, May 1965, p. 299-317. 25 refs.
NASA-supported research.
    Review of the principal techniques that have been used to estimate the surface pressure on Mars. The basic physics behind each technique is outlined and illustrated with simplified examples. An attempt is made to evaluate the reliability of each technique and its use to date. The problem is outlined, the older techniques (polarimetry and photometry) are examined, and the spectroscopic method, in which at least two CO_2 absorption bands are used to derive both the CO_2 abundance and the surface pressure, is reviewed. The conclusions are principally: (1) that the polarimetric and photometric techniques are not nearly so reliable as has been generally supposed; and (2) that, although the spectroscopic method should ultimately settle the problem, the data thus far available do not yield good accuracy in either the CO_2 content or the total pressure.   (Author) W. M. R.

A65-26272
LUNAR AND PLANETARY SURFACE CONDITIONS (Supplement 2 to ADVANCES IN SPACE SCIENCE AND TECHNOLOGY). Edited by F. I. Ordway, III (NASA, Marshall Space Flight Center, Huntsville, Ala.).
N. A. Weil (Cummins Engine Co., Inc., Research Div., Columbus, Ind.).
New York, Academic Press, Inc., 1965. 222 p.
$10.00.
    This book is a collection of available theoretical knowledge and experimental evidence on the surface conditions obtaining on the Moon and on the terrestrial and outer planets. Existing knowledge of these conditions is critically reviewed, the most probable alternatives are identified, and new hypotheses are advanced where they are considered warranted. Because there exists a close association between the space scientist and the technical specialist who must place a functioning data-collection system on these planetary surfaces, the author has attempted to compose the text so that it can be used with equal facility by scientific or professional personnel engaged in space research, by educators, or by graduate students in aerospace disciplines. In an introduction, the prevalent hypotheses on the origin and age of the solar system are presented; these are followed by a brief description of the methods of acquiring lunar and planetary data, either from fixed terrestrial observatories

or from instrumented or manned space probes. In the chapter devoted to the Moon, sections deal sequentially with the atmosphere, temperature conditions, subsurface stratification, field intensities (gravitational, electric, and magnetic), and with the biological conditions existing on the lunar surface. New information is presented on the density of the lunar atmosphere under quiescent or high-flux transient conditions, on the topography of the lunar surface, and on the probable proportion of crater-covered areas in the highlands and on the maria. A critical examination is made of the surface-forming mechanisms on the Moon, with predictions for the stratification, temperature profile, and composition (both chemical and meteoritic) of subsurface layers. The question of indigenous lunar life is reviewed and discarded. Equally detailed treatments are given of the surface conditions of the terrestrial planets, the Jovian planets, and Pluto. When these planets are situated at vast distances, are not easily observable, or possess cloud-mantled atmospheres, information about their surfaces is less complete than information about the surfaces of the Earth's nearer planetary neighbors.   D.H.

A65-26719 #
THE MARINER 4 OCCULTATION EXPERIMENT.
Arvydas J. Kliore, Dan L. Cain, Gerald S. Levy (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), Von R. Eshleman, Gunnar Fjeldbo (Stanford University, Stanford Center for Radar Astronomy, Stanford, Calif.), and Frank D. Drake (Cornell University, Center for Radiophysics and Space Research, Ithaca, N.Y.).
Astronautics and Aeronautics, vol. 3, July 1965, p. 72-80.
13 refs.
        Discussion of the Mariner IV occultation experiment, intended to improve knowledge of the atmosphere and ionosphere of Mars. Approximately one hour after its closest approach to Mars, the spacecraft will be occulted by the limb of the planet and will remain in occultation for approximately 50 min. Immediately before and immediately following occultation, the 2300-Mc tracking and telemetry signal of the spacecraft will traverse the atmosphere and ionosphere of Mars. The changes caused in the frequency, phase, and amplitude of the spacecraft signal by passage through these media will constitute the raw data of the experiment. The geometry of occultation is described, and the instrumentation and accuracy of the experiment are discussed. Problems of data analysis and interpretation of results are examined.   F.R.L.

A65-26720 #
A SUBSURFACE MARINE BIOSPHERE ON MARS?
Hubertus Strughold (USAF, Systems Command, Aerospace Medical Div., Brooks AFB, Tex.).
Astronautics and Aeronautics, vol. 3, July 1965, p. 82-86.
18 refs.
        Examination of the theory that the water of Mars may be locked beneath layers of dust and ice, supporting there a variety of chemosynthetic organisms. The theory first advanced by Baumann and developed by Davydov assumes that planetary materials from which Mars evolved include water in approximately the same proportion to the total mass as did those from which the Earth was formed. Because of the greater distance between Mars and the Sun, however, most of this water is now frozen and covered with dust from the frequent dust storms that sweep the planet. It is considered that if liquid water is found in substantial quantities below the surface of Mars, beneath a layer of ice measuring 0.5 km or more, the water may constitute a potential biosphere; the mechanism by which life could have originated and continue to exist is discussed.   F.R.L.

A65-26729 #
THE ROLE OF INFRARED SPECTROSCOPY IN THE BIOLOGICAL EXPLORATION OF MARS.
D. G. Rea (California, University, Space Sciences Laboratory, Berkeley, Calif.).
International Symposium on Basic Environmental Problems of Man in Space, 2nd, Paris, France, June 14-18, 1965, Preprint no. 9. 47 p. 31 refs.

Symposium sponsored by the International Astronautical Federation, International Academy of Astronautics, UNESCO, International Atomic Energy Agency, International Telecommunication Union, World Health Organization, and World Meteorological Organization; Grant No. NsG 101-61; Contract No. NASr-220.
        Discussion of the theory underlying infrared spectroscopy and summary of the remote infrared observations made of Mars. The emission and absorption characteristics of liquids, solids, and gases resulting from the electromagnetic dipole, rotational, and vibrational properties of their molecules are outlined. Infrared spectroscopy has provided information on the atmospheric composition, pressure, and other parameters which are vital in the designing of a lander to explore the surface of Mars for evidence of life. Infrared radiometry has been used to measure the surface temperatures for the entire disk during the various seasons. The possibilities afforded by a spacecraft orbiting Mars and by a landed vehicle in the search for life on that planet are detailed.   S.H.B.

A65-26783
INFRARED SPECTRUM OF MERCURY (λ = 1.0-3.9 μ).
V. I. Moroz (Moskovskii Gosudarstvennyi Universitet, Astronomicheskii Institut, Moscow, USSR).
(Astronomicheskii Zhurnal, vol. 41, Nov.-Dec. 1964, p. 1108-1117.)
Soviet Astronomy, vol. 8, May-June 1965, p. 882-889. 15 refs.
Translation.
[For abstract see Accession no. A65-15676 06-30]

A65-26914
PLANETARY ATMOSPHERES.
R. Jastrow (NASA, Goddard Space Flight Center, Goddard Institute for Space Studies, New York, N.Y.).
(Società Italiana di Fisica, Scuola Internazionale di Fisica Enrico Fermi, Corso 24, Varenna, Italy, June 4-16, 1962.)
IN: SPACE EXPLORATION AND THE SOLAR SYSTEM [LE RICERCHE SPAZIALI E IL SISTEMA SOLARE].
Edited by B. Rossi.
New York, Academic Press, Inc., 1964, p. 236-297.
        Discussion of the currently accepted picture of the origin and development of planetary atmospheres, beginning with the theory of stellar evolution. An approximate table is constructed of the atmospheric lifetimes (times in which a fraction $1 - e^{-1}$ of the original content of the atmosphere is lost by gravitational escape) of constituents of interest on the Moon, Mars, Earth, Venus, and Jupiter. These include the lightest gases, hydrogen and helium; atomic oxygen, representing the C, N, O group; and finally argon, as a representative of the heavier gases, but occurring in special abundance by virtue of the steady source provided throughout the life of the planet by the decay of radioactive potassium in the crust. A great deal of attention is given to problems in the identification of the major sources of energy for the Earth's upper atmosphere. By numerical integration of the heat conduction and hydrostatic balance equations, tables are constructed of the temperature, density, pressure, scale height, mean molecular weight, and the concentrations of N_2, O_2, C, He, and H for altitudes from 120 to 2050 km. They were unfortunately prepared before the presence of a helium layer was confirmed and do not allow for this, but in other respects they are seen to provide a realistic summary of atmospheric properties.   W.M.R

A65-26945
VISIBLE POLARIZATION DATA OF MARS.
D. G. Rea and B. T. O'Leary (California, University, Space Sciences Laboratory, Berkeley, Calif.).
Nature, vol. 206, June 12, 1965, p. 1138-1140. 6 refs.
Grant No. NsG 101-61.
        Discussion of the discrepancy in values derived by different methods for the surface pressure of Mars. A value of 90 mbar for this pressure, based on visible photometric and polarimetric work, has generally been accepted. Recently, however, a value of 25 mbar has been derived by Kaplan, Munch, and Spinrad from a curve-of-growth analysis of pressure-broadened carbon-dioxide

vibration-rotation lines in the near IR Martian spectra. It is suggested that this discrepancy can be accounted for by the presence of aerosol particles in the Martian atmosphere contributing an appreciable component to the observed brightness and polarization of Mars. Calculations are given indicating the feasibility of this explanation.   P.K.

A65-27015
LACK OF EFFECT OF IO ON JOVIAN 3.75-CM EMISSION.
John R. Dickel (Illinois, University, Observatory, Urbana, Ill.).
Nature, vol. 206, June 19, 1965, p. 1241, 1242.
    Investigation of the effect of Io on the synchrotron emission generated within the radiation belts in Jupiter's atmosphere. The position of Io was plotted against the results of observations at 3.75 cm, taken with a polarimeter on the 85-ft telescope at the University of Michigan. After correcting for the effects of the planet's rotation, no correlation was detected between the position of Io and degree of polarization, flux density, or position angle of the polarized radiation. It is concluded that, although Io has been observed to have an effect on the localized regions responsible for decameter bursts, it does not influence the overall structure of the Jovian magnetosphere, which is responsible for the nonthermal emission at centimeter wavelengths.   R.A.F.

A65-27098
POSSIBLE ALTERNATIVE CHEMISTRIES OF LIFE.
V. A. Firsoff.
Spaceflight, vol. 7, July 1965, p. 132-136. 11 refs.
    Discussion of chemical elements and compounds suitable for prolonged biomolecular evolution and chemical selection in light of varying planetary conditions of environment and temperature. The most salient chemical features of life are discussed as algebraic terms without the substitution of any definite chemical species for symbols. An important feature of the molecular structures occurring in biology is that of a state of labile equilibrium, under which they respond to stimuli in chemical terms but revert to original constitution once the disturbance is over. A solvent is necessary for chemical interchange and exchange; this and other considerations restrict any given life system to a fairly narrow temperature range. It is shown that the elements which exhibit the phenomena of catenated hydride formation and ready polymerization are those which are included in the Groups III to V of the periodic table. Reasons are given which show that boron is not suitable as an independent catenant, but that the elements in Group IV, including C, Si, and Geare. Hydrosilicons or silanes and germanes are described. Nitrogen is discussed as a suitable catenant, with particular reference to the B-N series of compounds which form polymers analogous to some of the hydrocarbons such as borazole, the analog of benzene. Various possible solvents are investigated in terms of their suitability for such catenant systems at differing environmental temperatures. NH_3, HF, F_2O and $HgBr_3$ are all possibilities, depending on the planetary temperatures. Catenant systems based on atoms of the noble gases which are polarized in the presence of strong dipole solvents, such as F_2O, are discussed as being applicable to very cold planets such as Pluto.   D.P.F.

A65-27146 #
A MICROWAVE RADIOMETER AND MEASUREMENT OF THE NATURAL RADIATION OF JUPITER.
O. N. Rzhiga, G. I. Slobodeniuk, V. N. Titov, and Z. G. Trunova (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR).
(Radiotekhnika i Elektronika, vol. 10, Feb. 1965, p. 364-367.)
Radio Engineering and Electronic Physics, vol. 10, Feb. 1965, p. 306-309. 12 refs. Translation.
[For abstract see Accession no. A65-18553 08-30]

A65-27550 #
STUDIES OF THE ROTATION OF VENUS [RECHERCHES SUR LA ROTATION DE VENUS].
C. Boyer.
L'Astronomie, vol. 79, June 1965, p. 223-228. 5 refs. In French.
    Discussion of telescopic observations of Venus made from 1957 to the present which are considered to indicate that the planet rotates in a retrograde sense during a period of approximately four days. The conclusion was reached on the basis of UV photographs

taken from eight observatories which, after an evaluation process, showed the regular appearance of a dark spot shaped like a recumbent Y. Additional evidence is cited from the Paris Observatory in the form of a series of measurements of radial velocities at different points on the disk of the planet, made by means of a sensitive interferential spectrograph which indicate, by Doppler effect, a four-day retrograde rotation. Certain irregularities in the observed period of rotation are considered to be due to meteorological effects in the Venusian atmosphere.   F.R.L.

A65-27569
STRUCTURE OF THE MARTIAN UPPER ATMOSPHERE.
Michael B. McElroy, Joseph W. Chamberlain (Kitt Peak National Observatory, Tucson, Ariz.), and Jean L'Ecuyer (Chicago, University, Yerkes Observatory, Williams Bay, Wis.).
Astrophysical Journal, vol. 141, May 15, 1965, p. 1523-1535. 26 refs.
    Computation of a number of models of the Martian thermosphere with various constants and boundary values in the hydrostatic and heat-flux equations. The investigation is divided into two main parts. First, the basic parameters are varied, one or two at a time, to find to what extent an uncertainty in one of these fundamental parameters affects the derived exospheric temperature and other characteristics of the upper atmosphere. These models are physically oversimplified but mathematically serve their purpose. Secondly, with selected specific chemical compositions, the equations are integrated with allowance for diffusive separation and absorption of sunlight in different spectral regions. A rather detailed and general discussion is included of the efficiency with which photon energy is converted into the kinetic energy of heat in the neutral atmosphere. The computed models are thought to be fairly representative of an actual atmosphere with the assumed compositions. It appears that CO vibrational excitation is not so important as a thermostat as was previously suggested, but the rotational levels of CO, and to a smaller extent the fine-structure levels of the ground term of O, may cause appreciable radiation loss. Direct observation of the Martian corona in the λ 1302 resonance radiation of O I should be possible and would allow the main present uncertainties to be removed.   (Author) W.M.R.

A65-27771 #
RADIOASTRONOMICAL OBSERVATION AND THE IONOSPHERE OF VENUS [RADIOASTRONOMICHESKIE ISSLEDOVANIIA I IONOSFERA VENERY].
A. D. Danilov (Akademiia Nauk SSSR, Institut Prikladnoi Geofiziki, Moscow, USSR).
Akademiia Nauk SSSR, Doklady, vol. 162, June 1, 1965, p. 774-777. 17 refs. In Russian.
    Survey of some results obtained by different authors in the course of the past year concerning the origin of Venus radio emission and its relation to the Venus ionosphere. Particular attention is given to results which indicate the presence of a dense ionosphere surrounding Venus and that radioastronomic observations may be influenced by this ionosphere. It is seen that this circumstance should be taken into account in the interpretation of observation data, irrespective of the type of model used to explain the total brightness-temperature spectrum of Venus radio emission.   V.P.

A65-28200
SIGNS OF LIFE - CRITERION-SYSTEM OF EXOBIOLOGY.
Joshua Lederberg (Stanford University, School of Medicine, Dept. of Genetics, Palo Alto, Calif.).
Nature, vol. 207, July 3, 1965, p. 9-13.
    Systematic criticism of the theoretical basis and operational methods of exobiology, the study of extraterrestrial life. The discussion in this case is limited to the possibility of life on Mars and is based on the supposition that the three evolutionary stages characterizing the earth's history have their counterparts in the development of Mars. Various approaches which might prove to be fruitful in determining the present stage of evolution of Mars are suggested. The launching of a Mars-orbiting observatory is considered an essential prerequisite to an actual landing on Mars.   A.B.K.

46

A65-28654 #
RECENT SPACE MEASUREMENTS WITH STRATOSPHERIC BAL-
LOONS [RECENTS RESULTATS SPATIAUX PAR BALLONS
STRATOSPHERIQUES].
R. Zander (Liège, Université, Institut d'Astrophysique, Liège,
Belgium).
Ciel et Terre, vol. 81, May-June 1965, p. 155, 156. In French.
    Discussion of the data concerning the composition of the
Venusian clouds, which appear to be formed of ice crystals, based
on telescopic observations of the planet Venus with helium-filled
stratospheric balloons. The experimental data were obtained at an
altitude of 26 km where absorption by the residual terrestrial at-
mosphere does not exceed 2% of its total value. A 30-cm automatic
telescope was used, coupled to a spectrometer for measuring ab-
sorption spectra. Two series of observations were made, one in
February, one in October 1964. Based on the absorption spectra
of the sun's IR radiations in the 1.6-3.4 μ range, the latter obser-
vations indicate that the clouds which mask the surface of Venus
are composed of water in the form of ice crystals.   D.P.F.

A65-28839 #
AERODYNAMIC BRAKING TRAJECTORIES FOR MARS ORBIT
ATTAINMENT.
Thomas W. Finch (Douglas Aircraft Co., Inc., Missile and Space
Systems Div., Santa Monica, Calif.).
(American Institute of Aeronautics and Astronautics, Annual Meeting,
1st, Washington, D.C., June 29-July 2, 1964, Paper 64-478.)
Journal of Spacecraft and Rockets, vol. 2, July-Aug. 1965,
p. 497-500. 5 refs.
NASA-supported research.
    Examination of the problems associated with aerodynamic
braking into a Martian orbit from the standpoint of vehicle and
trajectory capability. Mars entry corridors for lifting vehicles
are presented. Trajectories are developed which minimize the
propulsive orbit injection velocity increment. The magnitude of
the propulsive velocity increment is examined for these trajecto-
ries as a function of orbit altitude, vehicle lift/drag ratio, and
lift parameter, and entry velocity and peak load factor. It is
stated that, since the minimum propulsive velocity trajectories
are found to be impractical due to extreme sensitivity and lack
of control capability, a class of trajectories is proposed which
minimizes these difficulties. These alternate trajectories are
found to require larger propulsive velocities for orbit injection.
Propulsive velocity increments are again examined as functions
of orbit altitude, vehicle lift/drag ratio and lift parameter, and
entry velocity and peak load factor. It is noted that, since the
alternate trajectories provide orbital plane rotation capability,
the magnitude of the orbital plane rotation possible through aero-
dynamic maneuvering is examined as a function of the vehicle
lift/drag ratio.

A65-28841 #
SPACECRAFT HEAT-PROTECTION REQUIREMENTS FOR MARS
AERODYNAMIC BRAKING.
G. M. Hanley and F. J. Lyon (North American Aviation, Inc.,
Space and Information Systems Div., Flight Sciences Dept.,
Downey, Calif.).
(American Institute of Aeronautics and Astronautics, Annual Meeting,
1st, Washington, D.C., June 29-July 2, 1964, Paper 64-479.)
Journal of Spacecraft and Rockets, vol. 2, July-Aug. 1965,
p. 508-515. 13 refs.
Contract No. NAS 9-1748.
    Determination of the feasibility of decelerating a spacecraft by
aerodynamic braking to establish an orbit about the planet Mars.
The effect of vehicle shape on heat-protection weight at a nominal
entry velocity of 27,600 fps, and the effect of initial entry velocity
on heat shielding of a selected configuration for entry velocities
between 27,600 and 39,000 fps are studied. It is stated that, because
of the wide spread in current estimates of the constituents and den-
sity of the Martian atmosphere, their effect on the maximum heat-
protection weight and entry corridor depth is presented. The study
results are said to indicate that gas radiation is a major source of
gasdynamic heating during atmospheric braking, even for entry at
27,600 fps. Consequently, blunt shapes, such as the Apollo con-
figuration, have higher heat-protection weight requirements than
finer shapes such as the M-2 and high L/D delta wing shapes. As
a consequence of these initial study results, a modified conical

vehicle having a half-cone angle of 18° and an $(L/D)_{max} = 1.16$ was
studied to determine the effect of initial entry velocity on vehicle
heat-protection weight. The indications suggested by the results
of this analysis are provided.

A65-28940
STRATOSCOPE 2.
M. Blavet.
Electronique, June 1965, p. 245-249. In French.
    Stratoscope 2 is a balloon-elevated optical system capable of
making astronomical observations of planets, nebulae, and other
celestial objects at an altitude of 80,000 feet. The system, which
weighs 3 tons, is essentially free of the absorption and distortion
caused by atmospheric water vapor and dust. The optical equipment
includes: (1) a primary mirror 90 cm in diam., weighing 200 kg,
and constructed with a precision of 1/100,000 of a mm; (2) a control
system; (3) a 64-channel system of telemetry for long-distance con-
trol; (4) a guidance system with a precision of 0.02" of arc; and
(5) a suspension system which allows the telescope to be displaced
about multiple axes. There is a TV camera which is aligned with
the principal optical axis of the telescope. The optical system is
also equipped for spectrophotometry in the IR spectrum.   D.P.F.

A65-29113
SOLAR SYSTEM SCIENCE - 1964 LITERATURE SURVEY. I.
Edna O'Connell (RAND Corp., Santa Monica, Calif.).
Icarus, vol. 4, July 1965, p. 319-333.
    Bibliography containing 275 entries on various astronomical
subjects, published in the year 1964, and referring to 11 US,
British, and Soviet technical publications. The entries are dis-
tributed among 11 main subject headings: atmospheric physics,
cosmogony, interplanetary physics, planetary biology, meteorites,
planetary geodesy, planetary geology, planetary physics, solar
physics, solar-system dynamics, and solar-terrestrial relations.
                                                            D.P.F.

A65-29288 #
RECENT OBSERVATIONS OF SATURN.
Patrick Moore.
British Astronomical Association, Journal, vol. 75, June 1965,
p. 215, 216.
    Study of the ring system and atmosphere of Saturn. Searches
for Ring D were made and proved negative. In 1962, an interesting
feature was a vague white spot in the equatorial zone. In 1963, the
chief feature of the early part of the apparition was the brightness
of the south polar zone. Observations in 1964 showed that the whole
equatorial zone was chrome or brownish in hue. Because similar
but more striking color phenomena had just been seen on Jupiter,
it was difficult to avoid speculating whether solar influence might be
responsible.   M.F.

A65-29289 #
A POSSIBLE CLOUD ON MARS?
Patrick Moore.
British Astronomical Association, Journal, vol. 75, June 1965,
p. 217.
    Observation of clouds on Mars. During the present apparition
of Mars, conditions have been generally poor, but one or two possible
clouds have been detected. The most interesting of these was seen
on Feb. 27, 1965. A fairly well-defined white cloud was seen, placed
approximately over the western end of the Deucalionis Regio. Un-
fortunately the weather conditions for the next few nights were quite
hopeless, and when the area was next seen, there was no sign of the
cloud. The only other cloud phenomenon was seen on Mar. 28-29
in the area of Thymiamata. However this was by no means so clear
as that of Feb. 27. The observations were made with a 12-1/2-in.
reflector at 460x.   M.F.

A65-29491 ≠
THE BISTATIC RADAR-OCCULTATION METHOD FOR THE STUDY
OF PLANETARY ATMOSPHERES.
G. Fjeldbo and V. R. Eshleman (Stanford University, Center for
Radar Astronomy, Stanford, Calif.).
Journal of Geophysical Research, vol. 70, July 1, 1965, p. 3217-
3225. 7 refs.
NASA-sponsored research.

Theoretical studies of the characteristics of radio waves diffracted at the limb and refracted in the atmosphere of a planet. Sample computations have been made of atmospheric perturbations to the communication links to and from a Mars-flyby spacecraft having a trajectory that involves occultation of the spacecraft by the planet as seen from the earth. It is concluded that such a radio occultation experiment can provide important new information on the atmospheric scale height and surface density of a planetary atmosphere, and, when combined with other information, can help determine atmospheric constituents. (Author) F.R.L.

A65-29684

THE FEASIBILITY OF A VEHICLE USING ATMOSPHERIC BRAKING TO LAND ON THE PLANET MERCURY.
Gerald M. Roth and Herbert S. Shaw (General Electric Co., Missile and Space Div., Re-Entry Systems Dept., Philadelphia, Pa.).
American Institute of Aeronautics and Astronautics, Annual Meeting, 2nd, San Francisco, Calif., July 26-29, 1965, Paper 65-494. 16 p.
Members, $0.50; nonmembers, $1.00.
Postulation of atmospheres based on Kozyrev's observations of a possible hydrogen-rich composition to investigate the feasibility of using atmospheric braking to land a payload on Mercury. The atmospheres are compared to an atmosphere composed of such heavy inert gases as krypton and argon, which, until recently, were believed to comprise the planet's atmosphere. Entry trajectory analysis indicates that a high-drag lander configuration such as a Langley Research Center Tension Shell entering the hydrogen atmosphere can achieve impact velocity values of approximately one-half the initial entry velocity for a low $W/C_D A$ ($\sim$ 1 to 3 psf) and entry path angles $\gamma_e = -60°$. It is further shown that by using this atmospheric braking in a grazing trajectory coupled with a retardation system, the descent velocity can be reduced sufficiently to allow safe impact of an instrument payload. (Author) F.R.L.

A65-29766

AERODYNAMICS OF PLANETARY ENTRY CONFIGURATIONS IN AIR AND ASSUMED MARTIAN ATMOSPHERES.
Leland H. Jorgensen (NASA, Ames Research Center, Moffett Field, Calif.).
American Institute of Aeronautics and Astronautics, Annual Meeting, 2nd, San Francisco, Calif., July 26-29, 1965, Paper 65-318. 14 p. 22 refs.
Members, $0.50; nonmembers, $1.00.
Use of approximate and characteristics methods to predict the effect of gas composition on the forces and static stability of entry-type vehicles at speeds from 1.5 to 14 km/sec. A constant stratosphere temperature of $180°K$ and a density range from 10^{-5} to 10^{-1} times earth sea-level density were assumed. Two types of configurations have been considered: (1) those that are short and blunt, and (2) those that consist of a blunt nose followed by a cylinder and stabilized by a flare. For short blunt vehicles the predicted force and moment characteristics at any angle of attack and in any carbon dioxide-nitrogen composition are very close to those in air. For blunt-nosed flared-cylinder vehicles, the predicted stability is sensitive to gas composition, particularly at probable flight speeds below about 12 km/sec. In a carbon-dioxide atmosphere the stability might be as low as 60 to 70% of that in air. However, in an atmosphere in which there is considerably less carbon dioxide than nitrogen - e.g., a $0.2CO_2 - .8N_2$ composition - the stability should be reasonably close to that in air. For these predictions the dynamic pressure at the flare was computed by the blunt-body characteristics method of Lomax and Inouye, and real-gas thermodynamic properties were used. (Author) M.M.

A65-29982

INSTITUTE OF ENVIRONMENTAL SCIENCES, ANNUAL TECHNICAL MEETING, 11TH, CHICAGO, ILL., APRIL 21-23, 1965, PROCEEDINGS.
Mount Prospect, Ill., Institute of Environmental Sciences, 1965. 648 p.
Members, $9.00; nonmembers, $14.

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REPORT ON WORKING GROUP NO. 7 OF IEC/TC 50, ON DUST AND SAND TESTS. David Askin (U.S. Army, Frankford Arsenal, Philadelphia, Pa.), p. 573-576.

AN APPROXIMATE METHOD OF SIMULATING MECHANICAL IMPEDANCE IN VIBRATION TESTING. C. E. Nuckolls (Sandia Corp.), p. 577-581. [See A65-30057 19-32]

USE OF GAMMA RAYS TO MEASURE THE PROTON SHIELD EFFECTIVENESS FOR THE APOLLO COMMAND MODULE. Richard C. Ross and Aaron Krumbein (United Nuclear Corp.), p. 583-591. [See A65-30058 19-22]

CHRONIC WEIGHTLESSNESS SIMULATION IN BIOLOGICAL RESEARCH. Charles C. Wunder (Iowa, State University, Iowa City, Iowa), p. 593-602. 37 refs. [See A65-30059 19-05]

THE PLANNING OF AEROSPACE VIBRATION TESTS AND PROGRAMS. Roy W. Mustain (Douglas Aircraft Co., Inc., Huntington Beach, Calif.), p. 603-613. 19 refs. [See A65-30060 19-32]

CONTRASTS IN ENERGY BALANCES BETWEEN INDIVIDUAL LEAVES AND VEGETATED SURFACES. Kenneth R. Knoerr (Duke University, Durham, N.C.), p. 615-623.

THE METHODOLOGY OF TEST PLANNING APPLIED TO AN EXPERIMENTAL STUDY. Arthur R. Anderson (Cook Electric Co., Morton Grove, Ill.), p. 625-631. [See A65-30061 19-18]

ENVIRONMENTAL TESTING IN SUPPORT OF SATELLITE

DESIGN AT THE ROYAL AIRCRAFT ESTABLISHMENT. H. A. J. Prentice and J. R. Porter (Ministry of Aviation, Royal Aircraft Establishment, Farnborough, Hants., England), p. 633-643. 15 refs. [See A65-30062 19-31]

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A65-29998
THEORETICAL MODEL ATMOSPHERES OF VENUS.
Robert B. Owen (NASA, Marshall Space Flight Center, Huntsville, Ala.).
IN: INSTITUTE OF ENVIRONMENTAL SCIENCES, ANNUAL TECHNICAL MEETING, 11TH, CHICAGO, ILL., APRIL 21-23, 1965, PROCEEDINGS. [A65-29982 19-11]
Mount Prospect, Ill., Institute of Environmental Sciences, 1965, p. 113-122. 34 refs.

Consideration of several theoretical model atmospheres of the planet Venus and their modification or elimination, with the exceptio of Greenhouse Model "B." According to this latest model, the bright-side surface temperature of Venus is $750^\circ K$, and that of the dark side is $640^\circ K$; the derived surface pressure is at least 30 atmospheres. It is assumed that under these conditions no significant water vapor exists. Since the melting points of tin, lead, aluminum, magnesium, bismuth, and zinc might be reached on the bright side, molten pools of these metals could cover much of that area. Temperature at the dark pole has been estimated to be $540^\circ K$; with the high surface pressures, possible constituents of the lower atmosphere may condense out in that region. Therefore, seas around the dark pole may contain benzine, acetic acid, butyric acid, and phenol in the liquid state.   B.B.

A65-30110 #
FORECASTING HUMIDITY [O PROGNOZE VLAZHNOSTI].
Sh. A. Musaelian.
IN: HYDRODYNAMIC LONG-RANGE WEATHER FORECASTING [GIDRODINAMICHESKII DOLGOSROCHNYI PROGNOZ POGODY].
Edited by E. N. Blinova.
Moscow, Izdatel'stvo Nauka, 1964, p. 62-74. 8 refs. In Russian.

Solution of the problem of humidity transport in the atmosphere in planetary-scale processes. A nonlinear equation for forecasting specific humidity is linearized by the method of small perturbations. The linearized humidity equation is averaged with respect to time, and the time-averaged vertical-velocity fields are determined. The working formulas of the problem are derived. A method of determining certain constants figuring in the solution is described.
                                          A.B.K.

A65-30119
INFRARED ASTRONOMY.
Bruce C. Murray and James A. Westphal (California Institute of Technology, Pasadena, Calif.).
Scientific American, vol. 213, Aug. 1965, p. 20-29.

General survey of IR astronomy, methods of detecting IR radiation, and an evaluation of the results obtained from observations of the moon and the planets. The earth's atmosphere is transparent to radiation in the range from 0.7 to 5.2μ, opaque from 5.2 to 8μ, transparent again from 8 to 14μ, opaque from 14 to 17μ, and transparent again from 17 to 22μ range. From 22 to 1000μ the earth's atmosphere does not transmit because of the absorption bands caused by water vapor, which are broadened by the effect of atmospheric pressure. The development of IR detectors is described beginning with the primitive thermocouple, then followed by the Golay cell, the Low cryogenic bolometer, and terminating with the present-day sensitive semiconductors. Sinton's observations on the planet Mars are discussed, together with his work on Venus, Jupiter, and the moon.   D.P.F.

A65-30237 #
THERMAL EMISSION OF JUPITER [O TEPLOVOM IZLUCHENII IUPITERA].
A. P. Naumov and I. P. Khizhniakov (Gor'kovskii Gosudarstvennyi Universitet, Radiofizicheskii Institut, Gorki, USSR).
Astronomicheskii Zhurnal, vol. 42, May-June 1965, p. 629-638. 29 refs. In Russian.

Calculation of the optical thickness of the isothermal atmosphere $(130^\circ K)$ of Jupiter in the 1.3-mm to 3-cm band, assuming

from spectroscopic data that the planet's atmosphere consists of H_2, CH_4, and NH_3. Thermal emission levels and the brightness temperature of the planet are determined using nonisothermal atmospheric models for various temperature gradients and tropospheric heights h_c. The difference between the brightness temperature T_b and the IR temperature of the cloud layer at $h_c = 36.9$ km $(\lambda \simeq 1.25)$ is given as $\simeq 70°K$ for a temperature gradient of $-2.01°K/km$. The wavelength λ 1.05 to 1.54 cm is found to be most convenient for a comparison of theoretical and experimental results.   V.Z.

A65-30238

NATURE OF TRANSFORMATIONS ON THE SURFACE OF JUPITER
[O PRIRODE IZMENENII NA POVERKHNOSTI IUPITERA].
S. K. Vsekhsviatskii (Kievskii Gosudarstvennyi Universitet,
Kafedra Astronomii, Kiev, Ukrainian SSR).
Astronomicheskii Zhurnal, vol. 42, May-June 1965, p. 639-644.
14 refs. In Russian.
    Interpretation of conspicuous, rapid phenomena observed since 1962 on the surface of Jupiter by Soviet and other astronomers which appear to require a revision of accepted concepts concerning the nature of the processes on the planet. A tentative estimate gives the minimum amount of ash particles in the planet's atmosphere as 10^{21} to 10^{22} g, and the theory is advanced that the dark bands are ash particle accumulations resulting from gigantic volcanic eruptions. From the integral brightness attenuation, the albedo of a dark equatorial band observed in 1961 is found to be 0.06. Further systematic studies of the integral brightness and surface changes are urged.   V.Z.

A65-30321

TRANSLATIONAL AND ROTATIONAL MOTION OF A BODY
ENTERING THE MARTIAN ATMOSPHERE [TRANSLATIONS- UND
ROTATIONSBEWEGUNG EINES IN DIE MARSATMOSPHÄRE
EINTAUCHENDEN KÖRPERS].
Peter Hans Feitis (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.).
(Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, and
Deutsche Gesellschaft für Raketentechnik und Raumfahrt,
Jahrestagung, Berlin, West Germany, Sept. 14-18, 1964, Paper.)
Raumfahrtforschung, vol. 9, July-Sept. 1965, p. 124-131. In German.
    Derivation of the atmospheric parameters and the density distribution within the Martian atmosphere as a function of altitude, assuming that the perfect-gas law holds. The equations of motion of simple bodies are established and solved. The solution consists of equations for the velocity, acceleration, and time as explicit functions of altitude. The case of oblique entry into the atmosphere is also treated. It is shown how the altitudes at which acceleration and heating have their maximum can be calculated. A sphere entering the Martian atmosphere is considered, assuming that the center of gravity of the sphere does not coincide with its geometric center. The diameter containing the sphere's center of gravity is called its axis. First, the rotational motion of the sphere is considered, assuming that its axis is initially inclined with respect to the trajectory. The axis oscillates in a plane with an amplitude which first decreases and then increases after maximum acceleration is reached. When the sphere is spinning it performs a complicated precessional motion around the velocity vector. The precession angle first converges and then diverges.

A65-30676

RESPONSE OF MICROORGANISMS TO A SIMULATED MARTIAN
ENVIRONMENT.
Ervin J. Hawrylewicz, Charles A. Hagen, and Richard Ehrlich
(Illinois Institute of Technology, Research Institute, Life Sciences
Div., Chicago, Ill.).
IN: LIFE SCIENCES AND SPACE RESEARCH. VOLUME 3; INTER-
NATIONAL SPACE SCIENCE SYMPOSIUM, 5TH, FLORENCE,
ITALY, MAY 12-16, 1964. [A65-30671 19-04]
Symposium sponsored by COSPAR.
Edited by Marcel Florkin.
Amsterdam, North-Holland Publishing Co.; New York, John Wiley
and Sons, Inc., 1965, p. 64-73. 14 refs.
NASA-supported research.

Investigation of the survival of terrestrial microorganisms in a simulated Martian environment. The ultimate objective is to establish whether earth organisms can contaminate Mars. In addition, any demonstration of survival and growth in a simulated Martian environment will provide information relating to the biology of Mars. In the experimental design, exhaustive consideration was given to the duplication of the known and the theoretical environmental parameters of Mars. These included composition of the soil and the atmosphere, barometric pressure, moisture content, solar radiation, and diurnal temperature extremes. Based on these considerations, a simulated Martian summer environment was defined and used in the experiments. One group of microorganisms was selected from culture collections on the basis of their known characteristics. The other group was made of microorganisms isolated from soils. The soil samples were obtained from the Antarctic, from New Mexico and California deserts, and from the Colorado tundra. The studies showed that a number of microorganisms can survive the simulated Martian environment. However, no substantial growth under such conditions could be demonstrated. The ability of microorganisms to form spores as a mechanism for survival is discussed. Also, experiments utilizing augmented environments to establish minimum environmental conditions which will permit growth are described.
(Author) M.M.

A65-30682

ON ARTIFICIAL MARTIAN CONDITIONS REPRODUCED FOR
MICROBIOLOGICAL RESEARCH.
A. I. Zhukova and I. L. Kondratiev (Academy of Sciences, Moscow,
USSR).
(COSPAR, Meeting, 7th, and International Space Science Symposium,
5th, Florence, Italy, May 8-20, 1964, Paper.)
IN: LIFE SCIENCES AND SPACE RESEARCH. VOLUME 3; INTER-
NATIONAL SPACE SCIENCE SYMPOSIUM, 5TH, FLORENCE,
ITALY, MAY 12-16, 1964. [A65-30671 19-04]
Symposium sponsored by COSPAR.
Edited by Marcel Florkin.
Amsterdam, North-Holland Publishing Co.; New York, John Wiley
and Sons, Inc., 1965, p. 120-126.
    Approach to the solution of problems regarding the character of life on Mars, by simulating Martian conditions by means of data obtained from astrophysics. Experiments are described in which pure cultures of fungi and bacteria have been used, as listed in a table. Short-time exposure has enabled conclusions on the viability of 22 strains of microorganisms under chamber conditions when the insolation source is switched on. It is concluded that: (1) spores of mold fungi are more stable than spores of bacterial cells, and (2) not all tested forms of microorganisms are capable of retaining viability under conditions imitated in the installation.

A65-30683

ABIOGENIC SYNTHESIS ON MARS.
Richard S. Young, Cyril Ponnamperuma, and Barbara K. McCaw
(NASA, Ames Research Center, Moffett Field, Calif.).
IN: LIFE SCIENCES AND SPACE RESEARCH. VOLUME 3; INTER-
NATIONAL SPACE SCIENCE SYMPOSIUM, 5TH, FLORENCE,
ITALY, MAY 12-16, 1964. [A65-30671 19-04]
Symposium sponsored by COSPAR.
Edited by Marcel Florkin.
Amsterdam, North-Holland Publishing Co.; New York, John Wiley
and Sons, Inc., 1965, p. 127-138. 7 refs.
    Discussion of atmospheres capable of producing organic compounds under primitive conditions in the light of recent experimental evidence. The atmosphere of Mars is considered and in particular, the observations of Sinton of reflection spectra with feature at 3.45, 3.58, and 3.69 μ, which are attributed to C-H bands and to the presence of organic molecules. Colthup interprets these features as being representative of organic aldehydes and suggests, specifically, acetaldehyde. Many works have considered these observations as being indicative of life on Mars. Rea has offered alternative hypotheses. Experimental evidence is presented of yet another possible explanation: that organic compounds are being produced in the Martian atmosphere, and may be responsible for Sinton's observations. The influence of such syntheses on possible Martian organisms is discussed. Various possible Martian atmospheres were irradiated with ultraviolet light as well as with other

possible energy sources, and a variety of organic end products were identified. Martian atmospheres plus acetaldehyde as a starting point were also used and end-products analyzed. Possible abiogenic pathways for Mars are discussed. (Author) M. M.

A65-31247 #
TWILIGHT STUDIES OF PLANETARY ATMOSPHERES FROM SPACECRAFT [O SUMERECHNYKH ISSLEDOVANIIAKH PLA-NETNYKH ATMOSFER S KOSMICHESKIKH KORABLEI].
G. V. Rozenberg (Akademiia Nauk SSSR, Institut Fiziki Atmosfery, Moscow, USSR).
Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana, vol. 1, Apr. 1965, p. 377-385. In Russian.
Proposed use of an observer situated at great height above a planetary surface for the investigation of the planet's atmosphere from its twilight phenomena. Crepuscular events can be observed at greater distances and with better resolution than daylight events.
W. M. R.

A65-31267 #
THE TWO-FREQUENCY BISTATIC RADAR-OCCULTATION METHOD FOR THE STUDY OF PLANETARY IONOSPHERES.
G. Fjeldbo, V. R. Eshleman, O. K. Garriott, and F. L. Smith, III (Stanford University, Center for Radar Astronomy and Radioscience Laboratory, Stanford, Calif.).
Journal of Geophysical Research, vol. 70, Aug. 1, 1965, p. 3701-3710. 8 refs.
Grants No. NsG-377; No. NsG-30-60; No. NGR-05-020-065.
Method for the study of planetary ionospheres which is based on the use of radio waves propagated between the earth and a spacecraft on an occulting trajectory beyond the planet. Phase path, group path, or amplitude measurements made during spacecraft immersion into, and emersion from, the occulted zone could be used to deduce vertical electron density profiles at the two limb positions probed by the waves. If two or more harmonically related frequencies are used, the ionospheric measurements are self-calibrating; thus the extreme measurement and computational precision that otherwise would be required are avoided. Furthermore, the use of more than one frequency makes it possible to separate dispersive ionospheric effects from the nondispersive refractive effects of the neutral atmosphere, so that both neutral and ionized regions of the atmosphere could be studied in some detail. It is suggested that this simple technique would be particularly applicable for the initial exploration of planetary atmospheres. (Author) M. F.

A65-31279 #
ON THE INTERPRETATION OF THERMAL EMISSION MAPS OF JUPITER.
Robert L. Wildey (California Institute of Technology, Div. of Geological Sciences; Carnegie Institution of Washington and California Institute of Technology, Mount Wilson and Palomar Observatories, Pasadena, Calif.).
Journal of Geophysical Research, vol. 70, Aug. 1, 1965, p. 3796, 3797.
Study of mapping procedures for Jupiter. Because of the limitations on the accuracy of present mapping procedures, important discrimination must be made between structural features of maps which are obviously noise and those which are good candidates for the extraction of theoretical implications. The peculiar nature of the noise warrants an elaboration of this discriminatory procedure. The sources of noise are primarily photometric error and secondarily tracking error. Map noise of sufficient magnitude to appear as a pseudo-Jovographic feature betrays its presence by its tendency to form troughs and ridges which align themselves parallel to the general scanning direction. This tendency is seen to be highly variable from night to night, and examination of the signal tracings shows it to be correlated with the magnitude of that component of noise in the system which is nonstationary. With stationary noise photometric accuracy can be increased more or less indefinitely by decreasing the rate of scan while increasing the system time constant, because the sky level to be subtracted from the signal trace is a rigid constant which can be well determined simply by long measurement time. M. F.

A65-32321 #
A PROPOSED SOLUTION TO ENTRY VEHICLE DESIGN PENALTIES CAUSED BY LACK OF KNOWLEDGE OF THE MARS ATMO-SPHERE.
George M. Levin (NASA, Goddard Space Flight Center, Advanced Missions Analysis Group, Greenbelt, Md.).
American Institute of Aeronautics and Astronautics, Annual Meeting, 2nd, San Francisco, Calif., July 26-29, 1965, Paper 65-493. 16 p. 12 refs.
Members, $0.50; nonmembers, $1.00.
Proposed solution to the tremendous weight penalty in any entry-vehicle design due to lack of knowledge of atmospheric properties of Mars. The "stepping stone" concept of planetary exploration using a nonsurviving needle-nosed probe is discussed. The small probe would provide the needed atmospheric data for the efficient design of larger entry vehicles. Three sets of measurements would be made during entry: (1) dynamic and static pressure encountered by the probe to provide pressure and density profiles, (2) deceleration of the probe to provide independent density data, and (3) atmospheric composition measured with a mass spectrometer. Externally, the probe configuration will consist of a 9° half-angle conical nose, a cylindrical midsection, an 18° half-angle skirt, and a hemispherical afterbody. The sharp-nose, low-drag design is employed to minimize plasma interference with communication and permit continuous transmission of data (from the probe to a fly-by spacecraft or orbiter for subsequent relay to the earth) throughout the entire interval from initial atmospheric penetration to surface impact. The probe's overall length and total weight (not including separation mechanism) are 48 in. and 60 lb, respectively. The configuration will permit delivery of two or more probes from a single spacecraft, depending on overall mission definition. (Author) B. B.

A65-32416
BEHAVIOR OF PLANTS UNDER EXTRATERRESTRIAL CONDI-TIONS - SEED GERMINATION IN ATMOSPHERES CONTAINING NITROGEN OXIDES.
S. M. Siegel, Constance Giumarro, and Richard Latterell (Union Carbide Research Institute, Tarrytown, N.Y.).
National Academy of Sciences, Proceedings, vol. 52, July 1964, p. 11-13.
Contract No. NASw-767.
Experimental demonstration that seeds of common plant species can be germinated in rarefied nitrogen atmospheres containing high proportions of individual nitrogen oxides (N_2O, NO, NO_2) or their mixtures. A buffering substratum of $CaCO_3$ is especially beneficial, and the best responses thereto were given by rice and sorghum in the presence of certain nitrogen oxides as compared with nitrogen alone. Cell division in the sorghum shoot in N_2/NO was demon-strated. Nitrogen dioxide was inhibitory under anaerobic conditions, but much less so when O_2 was present. It is concluded that if ordina-ry terrestrial flora unselected for tolerance to the oxides of nitrogen are taken as a model, their prospects for growth in a nitrogen oxide-rich atmosphere would be good provided the substratum prevents excess acidity and that NO_2 is not present in excessive quantities.
F.R.L.

A65-32620
SELECTIONS FROM THE TRW SPACE TECHNOLOGY LABO-RATORIES; LECTURE SERIES. VOLUME 2.
Edited by T. L. Branigan (Space Technology Laboratories, Inc., Redondo Beach, Calif.).
Redondo Beach, Calif., Space Technology Laboratories, Inc., 1965. 70 p.

CONTENTS:
THE THEORY AND APPLICATION OF MASERS AND LASERS. Charles H. Townes (Massachusetts Institute of Technology, Cambridge, Mass.), p. 4-13. [See A65-32621 21-16]
THE BIOLOGICAL EXPLORATION OF MARS. Elliott C. Levinthal (Stanford University, Stanford, Calif.), p. 14-21. [See A65-32622 21-30]
THE EFFECTS OF HIGH-ALTITUDE EXPLOSIONS. Wilmot N. Hess (NASA, Goddard Space Flight Center, Md.), p. 22-34. 34 refs. [See A65-32623 21-29]

THE ABUNDANCE OF THE ELEMENTS. Harold C. Urey (California, University, La Jolla, Calif.), p. 35-46. 33 refs. [See A65-32624 21-30]

THEORETICAL ASPECTS OF THE SPACE RELATIVITY-GYROSCOPE EXPERIMENT. L. I. Schiff (Stanford University, Stanford, Calif.), p. 47-50. 10 refs. [See A65-32625 21-23]

ENERGETIC SOLAR PARTICLES. Kinsey A. Anderson (California, University, Berkeley, Calif.), p. 51-60. 23 refs. [See A65-32626 21-29]

THE ORIGIN OF PLANETARY ATMOSPHERES. A. G. W. Cameron (NASA, Goddard Institute for Space Studies, New York, N. Y.), p. 61-70. [See A65-32627 21-30]

A65-32627

THE ORIGIN OF PLANETARY ATMOSPHERES.
A. G. W. Cameron (NASA, Goddard Institute for Space Studies, New York, N. Y.).
IN: SELECTIONS FROM THE TRW SPACE TECHNOLOGY LABORATORIES; LECTURE SERIES. VOLUME 2.
Edited by T. L. Branigan.
Redondo Beach, Calif., Space Technology Laboratories, Inc., 1965, p. 61-70.

Discussion of the mechanisms explaining the origin of planetary atmospheres as due to outgassing or capture from a primitive solar nebula or solar wind. Atmospheres can be lost by reverse processes such as thermal evaporation, sweeping action of the solar wind, chemical reactions with surface materials, and the hypothetical case of excess planetary rotational velocity. On the basis of meager data that are available for the giant planets, it is reasonable to suppose that the bulk of their atmospheres was captured from a primitive solar nebula with the same composition as the sun. Hydrogen and helium would be the dominant elements. It is shown that the action of the solar wind would strip the moon of any atmosphere within a matter of months. Mercury can only have an atmosphere containing substantial amounts of molecules which can radiate efficiently. Lack of knowledge about the escape mechanisms for Mars precludes any definite conclusion about that planet's atmospheric composition. Experimental evidence seems to indicate that the Venusian atmosphere is about two orders of magnitude greater in mass than earth's. The latter's atmosphere is discussed in terms of the origins of atmospheric xenon.   D. P. F.

A65-32654

ABSOLUTE INTENSITY MEASUREMENTS IN THE EXTREME ULTRAVIOLET SPECTRUM OF SOLAR RADIATION.
H. E. Hinteregger (USAF, Office of Aerospace Research, Cambridge Research Laboratories, Bedford, Mass.).
Space Science Reviews, vol. 4, June 1965, p. 461-497. 50 refs.

Review of experimental results and problems of absolute intensity measurements of solar electromagnetic radiation in the EUV and soft X-ray region of the spectrum (designated cumulatively as "XUV" for brevity). The numerous practical problems are divided into two major areas - (1) general problems of heterochromatic absolute XUV spectrophotometry in the laboratory and (2) specific problems characteristic of requirements of solar physics, the physics of planetary atmospheres, and existing restrictions of space technology. Within the first area, emphasis is placed on recent progress toward justified reliance on ionization detectors without necessary connection to source standards. For the second area, emphasis is placed on the immediate need to have existing exploratory observations followed by a new phase of more systematic experiments of increased accuracy.   (Author) M. F.

A65-33289

THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS; PROCEEDINGS OF A CONFERENCE, NASA, GODDARD SPACE FLIGHT CENTER, GODDARD INSTITUTE FOR SPACE STUDIES, NEW YORK, N.Y., APRIL 8, 9, 1963.
Edited by P. J. Brancazio (NASA, Goddard Space Flight Center, Goddard Institute for Space Studies, New York; Brooklyn College, Brooklyn, N.Y.), and A. G. W. Cameron (NASA, Goddard Space Flight Center, Goddard Institute for Space Studies; New York University, New York, N.Y.).
New York, John Wiley and Sons, Inc., 1964. 314 p. $12.50.

CONTENTS:

A65-33292

ON THE CHEMICAL EVOLUTION OF THE TERRESTRIAL AND CYTHEREAN ATMOSPHERES.
Heinrich D. Holland (Princeton University, Princeton, N.J.).
IN: THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS; PROCEEDINGS OF A CONFERENCE, NASA, GODDARD SPACE FLIGHT CENTER, GODDARD INSTITUTE FOR SPACE STUDIES, NEW YORK, N.Y., APRIL 8, 9, 1963. [A65-33289 21-30]
Edited by P. J. Brancazio and A. G. W. Cameron.
New York, John Wiley and Sons, Inc., 1964, p. 86-100; Discussion, p. 100, 101. 11 refs.

Brief review of the history of the terrestrial atmosphere and consideration of a model, modified somewhat from the terrestrial model, which seems to account for the presently accepted data concerning the chemical composition of the atmosphere

of Venus. The data on the abundance of the nonvariable and variable constituents of our present atmosphere are summarized in tabular form. The ratio of Xe to Si in the earth was found to be lower by six or seven orders of magnitude than the ratio of Xe to Si in the cosmos. As it is difficult to see how the Xe in the earth's atmosphere could be reduced by a factor of 10^6; it is more reasonable to assume that at an arbitrary starting point, t = 0, there was essentially no atmosphere. The lack of a time trend in the ratio of ferrous to ferric iron in ancient basalts and diabases suggests that there has been no change in the oxidation state of volcanic gases during the past 1.8 billion years. On the other hand, it is probable that the chemistry of volcanic gases was quite different very early in the earth's history, for a period which lasted for less than 0.5 billion years, when methane, ammonia, and especially N were the predominant gases. There is geologic evidence that O_2 was not abundant in the atmosphere during the second period which lasted for some 1-1/2 billion years. During the third stage, which began some 2 billion years ago and continued to the present, O_2 content increased chiefly due to photosynthetic processes. Similar lines of thought are developed to explain what is known about the atmosphere of Venus.   D.P.F.

A65-33298 #
OUTGASSING PROCESSES ON THE MOON AND VENUS.
Thomas Gold (Cornell University, Ithaca, N.Y.).
IN: THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS; PROCEEDINGS OF A CONFERENCE, NASA, GODDARD SPACE FLIGHT CENTER, GODDARD INSTITUTE FOR SPACE STUDIES, NEW YORK, N.Y., APRIL 8, 9, 1963. [A65-33289 21-30]
Edited by P. J. Brancazio and A. G. W. Cameron.
New York, John Wiley and Sons, Inc., 1964, p. 249-255; Discussion p. 255, 256.
    Analysis of the phenomena related to outgassing processes on Venus and the moon. Using a terrestrial analogy for investigating the atmospheric conditions on Venus it is shown that the present-day earth's atmosphere is really only a small by-product of the gases that have come out of the ground; the outgassing of CO_2 or other carbon-containing gases is still in process. Applying the analysis to Venus, the consequences of a rise in surface temperature to the boiling point of water are considered and it is shown that the greenhouse effect could lead to thermal equilibrium. However, surface temperature is not related to the escape of gases from the top of the Cytherean atmosphere because of the cold trap which restricts the upward diffusion of water vapor. With respect to the moon and other small bodies with no magnetic field, the effect of the solar wind would effectively rule out the formation of any permanent atmosphere by interior-degassing phenomena. D.P.F.

A65-33299 #
OBSERVATIONS OF WATER VAPOR ON MARS AND VENUS.
A. Dallfus (Paris, Observatoire, Meudon, Seine-et-Oise, France).
IN: THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS; PROCEEDINGS OF A CONFERENCE, NASA, GODDARD SPACE FLIGHT CENTER, GODDARD INSTITUTE FOR SPACE STUDIES, NEW YORK, N.Y., APRIL 8, 9, 1963. [A65-33289 21-30]
Edited by P. J. Brancazio and A. G. W. Cameron.
New York, John Wiley and Sons, Inc., 1964, p. 257-266; ·Discussion, p. 266-268.
    Methods used for verifying the quantity of water vapor on Mars and Venus and an analysis of the results obtained. Water vapor was measured with a 20-in. telescope and the H_2O absorption band was detected by photometric rather than spectrographic methods; a birefringent monochromatic filter was used. By tuning the filter to give a particular transmission, the background intensity could be determined. When the transmission was changed 20 times per second, modulation was obtained and the intensity comparisons could be made photoelectrically. The intensity of the 1.4-μ band is so great that in order to observe it unsaturated by terrestrial water vapor, balloon and high-mountain observations were made. For Mars, the deduced and corrected value of water vapor was 1.5 x 10^{-2} gm/cm^2. For Venus a transmission band was chosen which would completely absorb the intense CO_2 bands. Corrected, ground-based observations on water vapor for Venus indicated a probable value of about 1 x 10^{-2} gm/cm^2, with a probable error of a factor of 2.   D.P.F.

A65-33300 #
THE ATMOSPHERE OF MERCURY.
G. Field (Princeton University, Princeton, N.J.).
IN: THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS; PROCEEDINGS OF A CONFERENCE, NASA, GODDARD SPACE FLIGHT CENTER, GODDARD INSTITUTE FOR SPACE STUDIES, NEW YORK, N.Y., APRIL 8, 9, 1963. [A65-33289 21-30]
Edited by P. J. Brancazio and A. G. W. Cameron.
New York, John Wiley and Sons, Inc., 1964, p. 269-276; Discussion, p. 277, 278.
    Description of evidence that the planet Mercury has an atmosphere, and a tentative interpretation of this evidence. It was thought that no atmosphere would exist because the escape velocity of such a body (with a radius 30% greater than that of the moon, but with 4.2 times more mass) is small and the high surface temperature approaches the critical value for the exospheric escape of light dance of this element in the earth's atmosphere and its concentration per gram of meteorite investigated. The phenomena relative to neutron capture are examined to determine in what way this observed discrepancy could be accounted for, and neutrons produced as a result of deuterium formation in the sun could account for the earth's xenon concentration through interaction of the solar wind with the terrestrial magnetosphere. A mechanism which·captures solar xenon with great efficiency but rejects neon, helium, and other elements is described, based on the mass-to-charge ratio.
                                        D.P.F.

A65-33301 #
THE ATMOSPHERE OF MARS.
Richard M. Goody (Harvard University, Cambridge, Mass.).
IN: THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS; PROCEEDINGS OF A CONFERENCE, NASA, GOODARD SPACE FLIGHT CENTER, GODDARD INSTITUTE FOR SPACE STUDIES, NEW YORK, N.Y., APRIL 8, 9, 1963. [A65-33289 21-30]
Edited by P. J. Brancazio and A. G. W. Cameron.
New York, John Wiley and Sons, Inc., 1964, p. 289-296; Discussion, p. 296-298. 6 refs.
    Discussion of information on the composition of the Martian atmosphere, including data available at the time of the Goddard Institute Conference. Polarimetric observations are described, and indications of the relative abundance of CO_2 were obtained by comparing spectra of Mars and the moon. The contributions made by Dollfus, Kaiper, de Vancouleurs, and others to the field of Martian atmospheric investigation are considered.   D.P.F.

A65-33302 #
ARE THE INTERIORS OF JUPITER AND SATURN HOT?
P. J. E. Peebles (Princeton University, Princeton, N.J.).
IN: THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS; PROCEEDINGS OF A CONFERENCE, NASA, GODDARD SPACE FLIGHT CENTER, GODDARD INSTITUTE FOR SPACE STUDIES, NEW YORK, N.Y., APRIL 8, 9, 1963. [A65-33289 21-30]
Edited by P. J. Brancazio and A. G. W. Cameron.
New York, John Wiley and Sons, Inc., 1964, p. 299-303. 5 refs.
    Investigation of the temperatures of the interiors of Jupiter and Saturn based on the examination of the composition and physical states of their atmospheres. Information on the general structure of the latter can be obtained from the known gravitational multipole moments J and K. It is assumed that both Jupiter and Saturn consist of a high-density core surrounded by a uniform mixture of H_2 and He. Interpolation from the ideal gas law to the calculated properties of the ground states gives fairly reliable estimates of the equations of state of hydrogen and helium. According to Aller, if the planets were taken to be completely cold, the density of hydrogen in the upper layers would be so high according to the assumed equation of state that the calculated value of the gravitational multipole moment for Saturn would be too large, while the indicated abundance of H_2 in Jupiter would greatly exceed cosmic and solar abundances. An adiabatic model with a temperature of 150°K at 3 atm is considered, and sources of discrepancy between observed and predicted K's are suggested.   D.P.F.

A65-33303 #

THE ATMOSPHERE OF JUPITER.
R. Wildt (Yale University, New Haven, Conn.).
IN: THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND
OCEANS; PROCEEDINGS OF A CONFERENCE, NASA, GODDARD
SPACE FLIGHT CENTER, GODDARD INSTITUTE FOR SPACE
STUDIES, NEW YORK, N.Y., APRIL 8, 9, 1963. [A65-33289 21-30]
Edited by P. J. Brancazio and A. G. W. Cameron.
New York, John Wiley and Sons, Inc., 1964, p. 304, 305; Discussion
G. Field (Princeton University, Princeton, N.J.) and G. J. Wasser-
burg (California Institute of Technology, Pasadena, Calif.), p. 305,
306.

Discussion of certain aspects of Jupiter's atmosphere, such
as the differential rotation between the NH_3 gas and the cloud ma-
terial first discovered by Spinrad in 1962. Spectra of Jupiter taken
at Victoria in 1954 also showed (as noted by Spinrad) an inclination
indicative of a differential rotation of 4 km/sec, with the NH_3 ro-
tating slower than the clouds. New spectra taken recently, however,
showed that no effect was present, which indicates that this phe-
nomenon is time-variable. In 1963 Spinrad determined the equivalent
widths of a few quadripole lines of the H_2 molecule in the near infra-
red, which enabled the total amount of molecular H_2 above the cloud
layers to be determined. Spinrad and Trafton's proposed working
composition for the Jovian atmosphere is discussed.   D.P.F.

A65-33549 #

MARS ROUND-TRIP MISSION ANALYSIS FOR THE 1975-1985
TIME PERIOD.
D. N. Lascody (Douglas Aircraft Co., Inc., Santa Monica, Calif.),
E. D. Thorson, H. W. Hawthorne, and G. Markus (Douglas Air-
craft Co., Inc., Missile and Space Systems Div., Santa Monica,
Calif.).
(American Institute of Aeronautics and Astronautics, Annual
Meeting, 1st, Washington, D.C., June 29-July 2, 1964, Paper
64-403.)
Journal of Spacecraft and Rockets, vol. 2, Sept.-Oct. 1965,
p. 775-780. 6 refs.
Contract No. NAS8-11005.

Review of an analysis of the energy and gross weight require-
ments of vehicle systems whose objective is the manned exploration
of Mars during the 1975 to 1985 period. It is seen that promising
missions, selected on the basis of minimum gross-weight in Earth
orbit, are available with long duration class transfers (800 to 1000
days) during the entire period, but are restricted to the 1980's if
short duration (360-600 day) missions are desired. The concept of
multi-mission vehicle design is considered, and the vehicle's
capability is determined for several synodic periods. This vehicle,
with a constant structural weight and tank size, is capable of per-
forming round-trip missions of various durations during several
synodic periods. Weight-saving techniques, such as utilizing ellip-
tical orbits at Earth departure, and at Mars, planetary atmospheric
braking, and high-speed Earth entry, are evaluated with regard to
feasibility, weight, and cost. It is seen that resulting weight savings
are not sufficient to justify the extra complexity required in the
mode of operation.

A65-33692 #

THE COMPOSITION OF THE VENUS CLOUDS AND IMPLICATIONS
FOR MODEL ATMOSPHERES.
Murk Bottema, William Plummer, John Strong, and Rodolphe Zander
(Johns Hopkins University, Laboratory of Astrophysics and Physical
Meteorology, Baltimore, Md.).
Journal of Geophysical Research, vol. 70, Sept. 1, 1965, p. 4401,
4402. 15 refs.
USAF-supported research.

Extension of previous work on balloon observations of the atmo-
sphere of Venus. The balloon-telescope flight of Feb. 21, 1964,
using reflected radiations near 1.1 μ, showed that the upper Venus
atmosphere contains water vapor in amounts comparable to those in
similar levels of the earth's atmosphere. Solar radiation reflected
by the Venus clouds in the IR spectrum region 1.7 and 3.4 μ was
measured on a subsequent flight. From the similarity between the
curves of the Venus spectrum and of the reflection spectrum of a
laboratory ice cloud, it is concluded that Venus clouds are composed
of ice crystals. The identification of the Venus clouds as ice

particles suggests an explanation of a phenomenon that must be
accounted for by any satisfactory model of the Venus atmosphere:
the temperature at the Venus cloud surface lies near -40°C. The
positive identification of the cloud particles as water and ice
requires that all knowledge of terrestrial clouds be applied to the
discussion of Venus, particularly in relation to the anomalously
high microwave brightness. Terrestrial observations show that
clouds emit nonthermal microwave radiation.   M.F.

A65-34633 #

THE INFRARED LIMB DARKENING OF VENUS.
James B. Pollack (Harvard University, Harvard College Observatory,
Cambridge, Mass.) and Carl Sagan (Harvard University; Smithsonian
Institution, Smithsonian Astrophysical Observatory, Cambridge,
Mass.).
Journal of Geophysical Research, vol. 70, Sept. 15, 1965, p. 4403-
4426. 28 refs.

Proposal of three general categories of models of the atmo-
sphere and clouds of Venus in order to explain the observed IR limb
darkening. In the 8- to 13-micron interval and over the observed
range of the cosine of the Venus zenith angle, this darkening can be
expressed as μ^α, where μ is the cosine of the zenith angle and
(according to two independent sets of measurements) α is approxi-
mately equal to 0.5. For each model, convective and then radiative
equilibrium is assumed. In Models A, limb darkening is attributed
to the temperature gradient in an unknown, approximately gray ab-
sorber above the visible cloud deck. Other properties of the absorber,
required so that $\alpha \approx 0.5$, render these models rather unlikely. In
Models B, limb darkening is attributed to a combination of the tem-
perature gradient and the angular dependence of the emissivity in
approximately gray multiply scattering clouds, initially with isotropic
phase functions. In convective Model B1, agreement with observation
is secured for moderate values of $\bar{\omega}_0$, the albedo for IR single scat-
tering, if the clouds are diffuse by terrestrial standards; high $\bar{\omega}_0$
implies more compact clouds. The temperature range with depth,
particle number density, and composition of the clouds is discussed.
Moderate variation of the extinction coefficient with depth in the
clouds has little effect on the predicted limb darkening over the range
in μ reliably observed, but closer to the limb, and for low values of
$\bar{\omega}_0$, such variation may significantly influence the limb darkening.
In radiative Model B2, high values of $\bar{\omega}_0$ lead to predictions of the
planetary bolometric albedo in conflict with observations. Moderate
values of $\bar{\omega}_0$ lead to the observed limb-darkening law if the 8- to
13-micron opacity is about 2.5 times the mean opacity, which is a
property of silicate clouds. The preceding models are extended to
anisotropic phase functions and to other values of α. An anisotropic
phase function of the form $\bar{\omega}_0(1 + \cos \Theta)$ increases the contribution
of the emissivity to α by about 20%. In Models C, the clouds coherent-
ly redistribute radiation emitted by the underlying atmosphere. The
absence of marked spectral features in 8- to 13-μ Venus spectros-
copy leads to the rejection of Model C. Methods are described
for removing the remaining ambiguity among the models.
                                                  (Author) M.F.

A65-34745

ATMOSPHERIC ELECTRICAL STUDIES OF OTHER PLANETS.
Robert E. Holzer (California, University, Institute of Geophysics
and Planetary Physics, Los Angeles, Calif.).
IN: PROBLEMS OF ATMOSPHERIC AND SPACE ELECTRICITY;
INTERNATIONAL CONFERENCE, 3RD, MONTREUX, SWITZER-
LAND, MAY 5-10, 1963, PROCEEDINGS. [A65-34713 23-13]
Conference sponsored by the International Association of Meteorology
and Atmospheric Physics, and International Association of Geomag-
netism and Aeronomy of the International Union of Geodesy and
Geophysics.
Edited by S. C. Coroniti.
Amsterdam, Elsevier Publishing Co., 1965, p. 573-576; Discussion,
p. 587-596.

Discussion of the possibility of obtaining advance information
about the electrical conditions prevailing in the atmospheres of
other planets by studies of the electromagnetic radiation emitted by
such planets. These investigations would use spacecraft outside of
the ionosphere. Obtaining such advance information on the nature
and electrical problems of planetary atmospheres other than that of
the earth is necessary in view of the fact that direct electrical

measurements on such planets are likely to be possible only within
a number of years.   D.P.F.

A65-34922 #
TWILIGHT STUDIES OF PLANETARY ATMOSPHERES FROM
SPACE SHIPS.
G. V. Rozenberg (Akademiia Nauk SSSR, Institut Fiziki Zemli,
Moscow, USSR).
(Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana,
vol. 1, Apr. 1965, p. 377-385.)
Academy of Sciences, USSR, Izvestiya, Atmospheric and Oceanic
Physics, vol. 1, Apr. 1965, p. 223-227. Translation.
[For abstract see Accession no. A65-31247 20-30]

A65-34959 #
A SATELLITE METHOD FOR PRESSURE AND TEMPERATURE
BELOW 24 KM.
Frederick F. Fischbach (Michigan, University, High Altitude
Engineering Laboratory, Ann Arbor, Mich.).
(American Meteorological Society, Annual Meeting, 45th, New York,
N.Y., Jan. 25-28, 1965, Paper.)
American Meteorological Society, Bulletin, vol. 46, Sept. 1965,
p. 528-532.
NASA-sponsored research.
   Description of an accurate and economical satellite method for
measuring atmospheric pressure and temperature over the globe
for altitudes below 24 km. The satellite, put into a circular polar
orbit which is sun-synchronous in a day-night plane, measures the
atmospheric refraction of light from various given stars. The
manner in which the resulting data can be used for density and
temperature calculations is described. The sources of error in the
method are examined, and the limitations of the system are
evaluated.   P.K.

A65-35022
COMPARISONS OF LABORATORY AND PLANETARY SPECTRA.
III - THE SPECTRUM OF JUPITER FROM 7750 TO 8800 Å.
Tobias Owen (Illinois Institute of Technology, Research Institute,
Astro Sciences Center, Chicago, Ill.; Arizona, University, Lunar
and Planetary Laboratory, Tucson, Ariz.).
Astrophysical Journal, vol. 142, Aug. 15, 1965, p. 782-786. 14 refs.
Contract No. NRO-46-791.
   Comparison of laboratory spectra of methane and ammonia with
a spectrum of Jupiter obtained by Kuiper and wavelengths tabulated
by Kiess, Corliss, and Kiess which has indicated that these gases
can account for all unidentified planetary absorptions in the spectral
region 7750 to 8800 Å. A methane band that overlaps the 7900-Å
ammonia band in the spectrum of Jupiter is held to be responsible
for the misidentification of ammonia in the spectrum of Saturn. The
assignment of vibrational frequencies to the observed methane bands
remains uncertain.   (Author) M.F

A65-35025
THE 8-14-MICRON APPEARANCE OF VENUS BEFORE THE 1964
CONJUNCTION.
J. A. Westphal, R. L. Wildey, and B. C. Murray (California
Institute of Technology, Pasadena, Calif.).
Astrophysical Journal, vol. 142, Aug. 15, 1965, p. 799-802.
   Description of the mapping of the 8 to 14-μ radiation from
Venus during the period from Dec. 15, 1963 to June 6, 1964, using
the 200-in. Hale telescope. Detailed maps for six days show the
morphology of the upper-atmosphere brightness temperature and
illustrate a number of anomalous features near the cusps. The
problem of atmospheric extinction and the derived brightness tem-
perature is discussed. The detailed brightness-temperature mapping
of Venus in the 8 to 14-μ region is said to indicate a complex
temporal variation in the thermal radiation from the Cytherian
atmosphere.   A.B.K.

A65-35112 #
SYSTEM DESIGN OF AN AUTOMATED LABORATORY AND ASSO-
CIATED ENTRY VEHICLE FOR UNMANNED MARTIAN EXPLORA-
TION.
C. E. Anderson and F. G. Beuf (General Electric Co., Missile and
Space Div., Re-entry Systems Dept., Philadelphia, Pa.).
International Astronautical Federation, International Astronautical
Congress, 16th, Athens, Greece, Sept. 13-18, 1965, Paper. 34 p.
   Outline of some of the results of a company-sponsored study
of an integrated laboratory system which might be landed on Mars
from a rocket of the Saturn V class, with a brief description of a
conceptual design of an entry vehicle for carrying it down through
the Martian atmosphere to a safe landing and deployment on the
planetary surface. The following conclusions are drawn: (1) it ap-
pears reasonable to assume that the carrier vehicle and the AMEL
(Automated Mars Exploration Laboratory) support subsystems can
be developed in time for a 1973 launch date; (2) using these subsys-
tems and a Saturn V launch vehicle, a laboratory containing up to
2400 lb of instruments and process control equipment could be
landed safely on the Martian surface; (3) the surface life of the
laboratory should be at least 2 earth years, to permit operation
during one complete cycle of Martian seasons; (4) in order to sample
most effectively, the AMEL should be capable of limited mobility on
the Martian surface; (5) if Saturn V is used for this mission, it would
be desirable to use its large weight-lifting capability to launch at
least two laboratories per rocket shot, thus strongly enhancing
mission reliability; and (6) definition of the measurements which
must be made and development of the required automated instru-
ments and processing equipment appear to be among the most criti-
cal long-lead problems.   M.M.

A65-35268
MEASUREMENTS OF POLARIZATION AND DISTRIBUTION OF
BRIGHTNESS TEMPERATURE OF VENUS AT 10.6 CM.
A. D. Kuz'min and B. G. Clark (Akademiia Nauk SSSR, Fizicheskii
Institut, Moscow, USSR; California Institute of Technology, Owens
Valley Radio Observatory, Calif.).
(Akademiia Nauk SSSR, Doklady, vol. 161, Mar. 21, 1965, p. 551-553.)
Soviet Physics - Doklady, vol. 10, Sept. 1965, p. 180, 181. Trans-
lation.
   Detection of differential polarization of radiation emitted by dif-
ferent parts of the visible disk of Venus. Measurements of the
brightness distribution over the surface of the planet in polarized
radiation were carried out at a wavelength of 10.6 cm. The results
are shown in a graph of the difference between the visibility functions
for polarization perpendicular and parallel to the effective base of
the interferometer, as a function of the resolution of the inter-
ferometer. The existence of differential polarization in the radio
emission of Venus is thus established. It thus appears that most of
this emission in the 10-cm band is from a continuous medium, which
is thought to be the surface of the planet.   R.A.F.

A65-35360
THE ABSORPTION INTENSITY OF THE $5\nu_3$ BAND OF CARBON
DIOXIDE, AND THE MARTIAN CO_2 ABUNDANCE AND ATMO-
SPHERIC PRESSURE.
Philip L. Hanst and Paul R. Swan (Avco Corp., Research and
Advanced Development Div., Wilmington, Mass.).
Icarus, vol. 4, Sept. 1965, p. 353-361. 9 refs.
   Recalculation of the atmospheric pressure of Mars. The
surface pressure of the Martian atmosphere strongly affects the
design and payload capabilities of Mars entry vehicles. The
current most widely accepted value of this surface pressure is
25 mb. This value was determined by Kaplan, Münch, and Spinrad
based on their observations of CO_2 absorption lines near 8700 Å
and on Sinton's and Kuiper's CO_2 observations at 2.06 μ. It is
noteworthy that their estimated value of 25 mb is a factor of 3 or
4 below estimates determined both by photometric and by polari-
metric techniques. A laboratory redetermination of the integrated
absorption intensity of the $5\nu_3$ band of CO_2 near 8700 Å has been
made with a long-path technique and photomultiplier detection.
This has resulted in a revision of the calibration used by Kaplan,
Münch, and Spinrad. In view of the importance of the surface
pressure to current studies of Mars probes, a recalculation of the
pressure utilizing the new laboratory measurements is carried out.

The results of the analysis give a revised value of (31 ± 13) m-atm for the Martian CO_2 abundance under the assumption of an effective temperature for the Martian atmosphere of 200°K. The surface pressure is now estimated, using this abundance value, to be (51 ± 25) mb.   (Author) M.F.

A65-35373
SOLAR SYSTEM SCIENCE - 1964 LITERATURE SURVEY. II.
Edna O'Connell (RAND Corp., Santa Monica, Calif.).
Icarus, vol. 4, Sept. 1965, p. 444-459.
    Bibliography containing 290 entries on various astronomical subjects. The articles, the great majority of which are in English, were published in 1964 in 18 technical publications. The entries are distributed among 11 main subject headings: atmospheric physics, cosmogony, interplanetary physics, planetary biology, meteorites, planetary geodesy, planetary geology, planetary physics, solar physics, solar-system dynamics, and solar-terrestrial relations.
                    R.A.F.

A65-35583
ULTRAVIOLET REFLECTIVITY OF MARS.
Dennis C. Evans (NASA, Goddard Space Flight Center, Greenbelt, Md.).
Science, vol. 149, Aug. 27, 1965, p. 969-972. 24 refs.
    Analysis of UV spectrograms of Mars (2400 to 3500 Å, ~50-Å resolution) obtained with an objective grating spectrograph on an Aerobee rocket. The data indicate a reflectivity of 0.04 to 0.08 in the UV, increasing toward shorter wavelength according to a Rayleigh law. The data can be represented by a model having an atmosphere of nitrogen, carbon dioxide, and argon, and a surface pressure of about 5 to 20 mbar. The photographic appearance of the planet in the blue is interpreted as a loss of surface contrast and reflectivity rather than an absorption in the atmosphere by the "blue haze." The model permits prediction of the general appearance of the planet in the photographic UV, blue, visible, and red. There are serious biological implications since the model suggests that UV radiation (2000 to 3000 Å) will reach the surface.
                    (Author) F.R.L.

A65-35585
SATURN'S RING AND THE SATELLITES OF JUPITER - INTERPRETATIONS OF INFRARED SPECTRA.
Tobias Owen (Arizona, University, Lunar and Planetary Laboratory; Kitt Peak National Observatory, Tucson, Ariz.).
Science, vol. 149, Aug. 27, 1965, p. 974, 975. 7 refs.
Contract No. NR-046-791.
    Infrared observation of Saturn's ring and the Galilean satellites of Jupiter to extend the study of the spectra of these bodies to longer wavelengths: 11,000 Å in the case of Saturn, and 9700 Å for the Jovian satellites. The results are seen to support Kuiper's suggestion for the composition of the ring - i.e., that it is composed of water ice. The absence of the strong absorption at 8873 Å in the spectra of Io, Ganymede, and Callisto leads to a new upper limit for the abundance of methane in possible atmospheres of these satellites.   F.R.L.

A65-35711 #
EFFECT OF SPECULAR GROUND REFLECTION ON RADIATION LEAVING THE TOP OF A PLANETARY ATMOSPHERE.
Robert S. Fraser (Thompson Ramo Wooldridge, Inc., Redondo Beach, Calif.).
American Institute of Aeronautics and Astronautics, Thermophysics Specialist Conference, Monterey, Calif., Sept. 13-15, 1965, Paper 65-664. 8 p.
Members, $0.50; nonmembers, $1.00.
NASA-supported research.
    Computation of the outward flux and intensity of scattered radiation for the top of a Rayleigh atmosphere that lies above a smooth water surface, which reflects radiation according to Fresnel's law. The polarization characteristics of the radiation are taken into account. The albedo of the water is less than 0.10, if the solar zenith angle is less than 65°. The flux and intensity at the top of the atmosphere are given for several streams that compose the radiation field. The characteristics of the stream of radiation

that has been reflected from the ground at least twice are hard to compute, but this stream contributes less than 0.01 to the flux and intensity at the top of the atmosphere. If the flux and intensity are compared with the corresponding quantities computed for the model of a Rayleigh atmosphere and Lambert ground reflection, the fluxes for the two models differ by less than 0.05, if the solar zenith angle is less than 78°; but the intensity differences become large at optical thickness less than 0.5.   (Author) M.F.

A65-35841 #
RADIO EMISSION OF SATURN ON A WAVELENGTH OF 8 MM [RADIOIZLUCHENIE SATURNA NA VOLNE 8 MM].
B. G. Kutuza, B. Ia. Losovskii, and A. E. Salomonovich (Akademiia Nauk SSSR, Fizicheskii Institut and Institut Radiotekhniki i Elektroniki, Moscow, USSR).
Akademiia Nauk SSSR, Doklady, vol. 161, Apr. 21, 1965, p. 1301, 1302. 10 refs. In Russian.
    Measurement of the luminance temperature of Saturn in the millimeter range. The experiment was conducted during July and August, 1964, using a radio telescope with a normal modulation radiometer at 8 mm. To protect against error, the experimenters simultaneously recorded the radio emission of Jupiter. The value obtained for the luminance temperature of Saturn at a wavelength of 8 mm is 132 ± 9°K. This is considered to agree well with previous values obtained for luminance temperature at other wavelengths.   R.A.F.

A65-36323
MARINER IV MEASUREMENTS NEAR MARS - INITIAL RESULTS.
Hugh R. Anderson (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.).
Science, vol. 149, Sept. 10, 1965, p. 1226-1228. 6 refs.
    Description of the Mariner IV spacecraft and of its encounter sequence during its approach and occultation of Mars on July 14 and July 15, 1965. Measurements made of the magnetic field and the various particle fluxes near Mars during the time preceding picture transmission are described, and an experiment is discussed in which the behavior of the radio signal transmitted by the spacecraft as it was occulted by Mars is used to infer properties of the planet's atmosphere.   B.B.

A65-36325
SEARCH FOR TRAPPED ELECTRONS AND A MAGNETIC MOMENT AT MARS BY MARINER IV.
J. J. O'Gallagher and J. A. Simpson (Chicago, University, Enrico Fermi Institute for Nuclear Studies, Dept. of Physics, Chicago, Ill.).
Science, vol. 149, Sept. 10, 1965, p. 1233-1239. 16 refs.
Grants No. NsG-179-61; No. AF AFOSR 521-65; Contract No. JPL-950615.
    Analysis of the attempt of the Mariner IV spacecraft to find trapped electrons and a magnetic moment at Mars during its flyby of that planet on July 14-15, 1965. No evidence of charged-particle radiation was found in the bow-shock, magnetospheric boundary, or transition regions. In view of these results, an upper limit is established for the Martian magnetic moment, provided it is assumed that the same physical processes leading to acceleration and trapping of electrons in the earth's magnetic field would be found in a Martian magnetic field. Accordingly, the upper limit for the Martian magnetic moment is found to be 0.1% of that of the earth for a wide range of postulated orientations with respect to the rotational axis of Mars. The implications of these results for the physical and biological environment of Mars are briefly discussed.
                    B.B.

A65-36328
OCCULTATION EXPERIMENT - RESULTS OF THE FIRST DIRECT
MEASUREMENT OF MARS'S ATMOSPHERE AND IONOSPHERE.
Arvydas Kliore, Dan L. Cain, Gerald S. Levy (California Institute
of Technology, Jet Propulsion Laboratory, Pasadena, Calif.),
Von R. Eshleman, Gunnar Fjeldbo (Stanford University, Center for
Radar Astronomy, Stanford, Calif.), and Frank D. Drake (Cornell
University, Dept. of Astronomy, Ithaca, N.Y.).
Science, vol. 149, Sept. 10, 1965, p. 1243-1248. 8 refs.
Grants No. NGR-05-020-065; No. NsG-377.
    Description of the use of coherent radio transmission to probe
the atmosphere and ionosphere of Mars. The refractivity and
density of the atmosphere near the surface, the scale height in the
atmosphere, and the electron density profile of the Martian iono-
sphere are estimated. It is concluded that the atmospheric density,
temperature, and scale height are lower than previously predicted,
as are the maximum density, temperature, scale height, and
altitude of the ionosphere.   B.B.

1966

IAA ENTRIES

A66-15288
THE $5\nu_3$ BAND OF CARBON DIOXIDE-R-BRANCH INTEGRATED
INTENSITY.
Robert W. Boese, Jacob H. Miller, and Edward C. Y. Inn (NASA,
Ames Research Center, Space Sciences Div., Moffett Field, Calif.).
Astrophysical Journal, vol. 142, Oct. 1, 1965, p. 1272, 1273.
    Determination of the intensity of the R-branch lines of the $5\nu_3$
band of CO_2 from the integral of the absorption coefficient. From
measurements of the rotational lines J = 0 to J = 48 in the R-branch,
using path lengths of 100, 200, and 400 m at a pressure of 3.1 atm
and a temperature of 291°K, a mean value of 0.381 $cm^{-1}km^{-1}amagat^{-}$
is obtained.   A.B.K.

A66-15415 #
LIGHT SCATTERING IN THE ATMOSPHERES OF THE PLANETS
[O RASSEIANII SVETA V ATMOSFERAKH PLANET].
I. N. Minin.
Leningradskii Gosudarstvennyi Universitet, Astronomicheskaia
Observatoriia, Trudy, vol. 22, 1965, p. 39-43. 5 refs. In
Russian.
    Derivation of approximate formulas for light passage through
planetary atmospheres of finite optical thickness, taking into account
polarized light scattering by aerosols and the light polarization due
to reflection from the atmospheric "bottom." The formulas are
suggested for use in the study of the optical properties of the Martian
atmosphere.   V.Z.

A66-15759
PLANETARY ATMOSPHERES.
R. Jastrow and S. I. Rasool (NASA, Goddard Space Flight Center,
Greenbelt, Md.).
IN: INTRODUCTION TO SPACE SCIENCE   (Professional Edition).
Edited by W. N. Hess.
New York, Gordon and Breach Science Publishers, Inc., 1965,
p. 669-699. 16 refs.
    Study of the properties and characteristics of the atmospheres
of the planets and their composition. The effect of gravitational
escape on the composition of a planet's atmosphere is examined
in terms of density distribution in the exosphere. Temperature,
density, and composition are the basic atmospheric data. Of these
temperature is the most important because it directly reflects the
processes of absorption of solar energy which in turn determine
atmospheric structure. The probable composition and properties
of the atmospheres of Mercury, Mars, Venus, and Jupiter are de-
scribed.   D.P.F.

A66-15777 #
EMISSION AND ABSORPTION OF RADIANT ENERGY IN A MODEL
PLANETARY ATMOSPHERE.
H. G. Myer, J. T. Ohrenberger, and T. R. Thompson (Thompson
Ramo Wooldridge, Inc., TRW Systems Group, Aerophysics Dept.,
Redondo Beach, Calif.).
AIAA Journal, vol. 3, Dec. 1965, p. 2203-2210. 19 refs.
    Radiation charts are developed for a model planetary atmosphere
composed of 15% CO_2 and 85% N_2 by volume. At this time such a
composition is considered representative of the Martian atmosphere.
The effect of varying CO_2 concentration in a CO_2-N_2 atmosphere and
the effect of percentage of argon are studied for a specific flight con-
dition. Self-absorption of radiation within the gas is examined and
is found to be of considerable significance in limiting the total amount
of radiation leaving a volume of gas. The results are applied to a
large spacecraft for which radiant heating is determined during a
braking maneuver within the Martian atmosphere.   (Author)

A66-15915 #
NUCLEIC ACID AND THE ORIGIN OF LIFE.
Alan E. Slater.
International Astronautical Federation, International Astronautical
Congress, 16th, Athens, Greece, Sept. 13-18, 1965, Paper. 4 p.
    Calculation of the probability of a nucleic acid molecule re-
producing itself in a favorable natural environment. It is seen that
the odds on the development of life on the earth arising as pure
happenstance cover the range from 10^{41} to 1 in favor to $> 10^{1000}$ to 1
against, depending on the initial assumptions. It is concluded that,
even if the universe is finite (in size, duration or both) the possibility
of life's beginning somewhere cannot be ruled out altogether, and
that the fact that there is life on the earth can be logically accounted
for.   R.A.F.

A66-16039
SOME EFFECTS OF THE MARTIAN ATMOSPHERE ON ELECTRO-
MAGNETIC RADIATION FROM MARINER IV.
H. D. Cubley and A. H. LaGrone (Texas, University, Dept. of
Electrical Engineering, Austin, Tex.).
IEEE Transactions on Antennas and Propagation, vol. AP-13,
Nov. 1965, p. 985, 986.
Grant No. AF AFOSR 766-65.
    Investigation of the diffraction effects to be expected when the
2300-Mc telemetry signal from Mariner IV is attenuated by the
Martian atmosphere and blocked by the planet itself. The refractivi-
ty N derived for two extreme versions of the Martian atmosphere
(the upper and lower limits) is tabulated. The Martian ionosphere
was considered (and found) to have negligible effect at 2300 Mc.
The variation in field strength observed on earth due to the occula-
tion of Mariner IV by Mars was solved analytically. The determina-
tion of some of the properties of the Martian atmosphere by com-
paring the observed and predicted diffraction curves is discussed.
                                                               M.F.

A66-16323 #
AUTOMATED LIFE DETECTION.
Richard S. Young (NASA, Ames Research Center, Exobiology Div.,
Moffett Field, Calif.).
Astronautics and Aeronautics, vol. 3, Oct. 1965, p. 70-76.
    Consideration of optimization criteria applicable to a choice of
experiments designed to verify the existence of life on the planet
Mars. The latest data relative to the Martian atmosphere and sur-
face conditions are reviewed. The existence of life can be charac-
terized by growth, movement, irritability, reproduction, and
metabolism. In view of the conditions assumed to be prevalent on
Mars (extreme diurnal temperature changes), it is shown that
chemistry, metabolism, and reproduction seem to be the most
suitable criteria upon which an experimental life-detection program
could be based. The problems related to chemical life-detection
tests are discussed; one of the main problems in the design of
metabolic experiments will be the selection of substrates. Heat as
a by-product of metabolism may prove to be a more useful criterion.
The problems connected with the identification of reproduction as a
criterion for life are discussed.   D.P.F.

A66-16404

ATMOSPHERE OF MARS.

F. S. Johnson (Southwest Center for Advanced Studies, Earth and
Planetary Sciences Laboratory, Dallas, Tex.).
Science, vol. 150, Dec. 10, 1965, p. 1445-1448. 8 refs.
Grant No. NsG-269-62.

The Martian ionospheric observations made by Mariner IV
are interpreted in terms of an atmospheric model. The ion peak is
identified as an F2 peak, that is, as a maximum whose profile is
controlled by ambipolar diffusion. The principal features of the
resulting atmospheric model are that the atmosphere consists
mainly of carbon dioxide, the temperature is very low, and there is
no thermosphere. Surface temperature is 210°K. The tropopause
occurs at an altitude of 14 kilometers and has a temperature of
140°K. Above the tropopause, the temperature decreases with al-
titude at the rate of 0.64°C km⁻¹, following the solid carbon dioxide
vapor-pressure curve up to 100 km, where the temperature is 85°K;
at higher altitudes the temperature is isothermal.   (Author)

A66-16436

THE ELECTROMAGNETIC PROPAGATION CHARACTERISTICS
OF VENUS AND MARS.

Charles E. Francis (Bell Aerospace Corp., Bell Aerosystems Co.,
Tucson Research Laboratory, Tucson, Ariz.).
IEEE, Proceedings, vol. 53, Sept. 1965, p. 1216-1221. 24 refs.

Examination of the information available about Mars and Venus,
and their atmospheres, to determine the electromagnetic propaga-
tion characteristics of the two planets. Consideration of some
preliminary model atmospheres indicates that the electromagnetic
propagation effective radius of Venus is between 7400 and 13,900
km. Other models, which give even larger effective radii and lead
to the limit of a plane surface, are discussed. The troposphere of
Mars, because of its low density, is shown to have essentially no
effect on the propagation loss between points on the surface or near
the surface. An examination of the knowledge of the dielectric
constants and conductivities of the surface revealed considerable
uncertainties. Measured values of the dielectric constant are
between 2.2 and 7.1 for the Venusian surface. The conductivity
is probably 10⁻³ mhos/meter or less for both the Venusian and
Martian surfaces, if they have compositions similar to dry terrestrial
soil. No measurement of the dielectric constant of the surface of
Mars has been published. Mars and Venus are strongly believed to
have ionospheres in their atmospheres, but only crude estimations
are available for the electron densities and the altitudes of these
ionospheres.   (Author)

A66-16625

RADIOASTRONOMICAL STUDIES AND THE IONOSPHERE OF
VENUS.

A. D. Danilov (Akademiia Nauk SSSR, Institut Prikladnoi Geofiziki,
Moscow, USSR).
(Akademiia Nauk SSSR, Doklady, vol. 162, June 1, 1965, p. 774-777.)
Soviet Physics - Doklady, vol. 10, Dec. 1965, p. 483-486. 17 refs.
Translation.
[For abstract see issue 17, page 2550, Accession no. A65-27771]

A66-17174 #

THE NATURE OF RADIO-NOISE EMISSION FROM THE SURFACE
OF VENUS [O PRIRODE RADIOSHUMOVOGO IZLUCHENIIA
POVERKHNOSTI VENERY].

V. M. Vakhnin and A. I. Lebedinskii.
Kosmicheskie Issledovaniia, vol. 3, Nov.-Dec. 1965, p. 917-926.
17 refs. In Russian.

Discussion of a model for the radio-noise emission of Venus
which explains the high level of this emission (600 to 700°K) in
terms of "quiet" or "glow" discharges that take place in the upper
atmosphere of Venus and cause an increase in the true thermal
radio emission by 200 to 300°K. An explanation of the development
of atmospheric glow discharges, instead of thunderstorm phenomena
characteristic of the earth's atmosphere, is seen in the very slow
rotation of the planet and the associated intense but hardly turbulent
atmospheric circulation. Calculations of the efficiency of solar
thermal energy conversion to radio noise (stepwise: first into
energy of atmospheric circulation and then into electric-current
energy) are seen to support the model proposed.   V.P.

A66-17247

REMARKS ON THE SHAPE OF A SPECTRAL LINE IN THE RADIA-
TION DIFFUSED BY A PLANETARY ATMOSPHERE [REMARQUES
SUR LA FORME D'UNE RAIE SPECTRALE DANS LE RAYONNE-
MENT DIFFUSE PAR UNE ATMOSPHERE PLANETAIRE].

Jacqueline Lenoble (Lille, Université, Département de Physique,
Laboratoire d'Optique Atmosphérique, Lille, France).
Académie des Sciences (Paris), Comptes Rendus, vol. 261, no. 22,
Nov. 29, 1965, p. 4633-4636. In French.

Calculation of the spectral distribution of the albedo and the
luminance at the center of the disk for a diffusing and absorbing at-
mosphere. From a study of three absorption lines of various strengths,
using two different diffusion laws to exemplify isotropic and aniso-
tropic diffusion, it is found that the maximum attenuation and the line
shape vary rapidly with the observation conditions and the diffusion
law. It is emphasized that great precautions must be taken when ab-
sorption lines appearing in the spectrum of a planet with a diffusing
atmosphere are used to evaluate temperature or pressure.   A.B.K.

A66-17891 #

EXPERIMENTAL ASSESSMENT OF THE EFFECT OF LARGE
AMOUNTS OF ARGON IN A PLANETARY ATMOSPHERE ON
STAGNATION-POINT CONVECTIVE HEATING.

T. E. Horton and T. L. Babineaux (California Institute of Technol-
ogy, Jet Propulsion Laboratory, Pasadena, Calif.).
American Institute of Aeronautics and Astronautics, Aerospace
Sciences Meeting, 3rd, New York, N.Y., Jan. 24-26, 1966,
Paper 66-29. 16 p. 27 refs.
Members, $0.50; nonmembers, $1.00.

Hypersonic stagnation-point convective-heat-transfer data
were obtained utilizing an arc-heated shock tube to simulate flight
velocities ranging from 18,000 to 34,000 fps. The mixtures in-
vestigated consisted of 65% CO₂-35% A, 30% CO₂-40% N₂-30% A, and
9% CO₂-90% N₂-1% A. In addition, tests were conducted in air to
establish a base to which the heating rates in the above mixtures
could be compared. The results of this investigation indicate an
increase in heat transfer in the atmospheric mixtures containing
large amounts of argon for the flight range where ionization be-
comes significant. For the 30% CO₂-40% N₂-30% A mixtures this
increase, above the values obtained in air, was about 10%; while,
for the 65% CO₂-35% A mixture the values of the heat-transfer
parameter were about 25% above those of air and 15% above theoret-
ical values. In the Martian entry range below 25,000 fps, the
ionization is not significant and heat-transfer rates are similar to
those in the non-argon atmospheres.   (Author)

A66-17900 #

THE MARINER 4 OCCULTATION EXPERIMENT - SUMMARY OF
DATA AND REDUCTION METHODS.

D. L. Cain, A. J. Kliore, and G. S. Levy (California Institute of
Technology, Jet Propulsion Laboratory, Pasadena, Calif.).
American Institute of Aeronautics and Astronautics, Space Sciences
Meeting, 3rd, New York, N.Y., Jan. 24-26, 1966, Paper 66-148.
10 p. 7 refs.
Members, $0.50; nonmembers, $1.00.

Brief review of the Mariner 4 occultation experiment, which
used the changes in amplitude and frequency of the tracking and
telemetry signal to yield data about the atmosphere of Mars. The
experiment required the measurement of frequency to tenths of a
cps in a signal of 2.3 x 10⁹ cps. This accuracy was made pos-
sible by use of the JPL/NASA Deep Space Instrumentation Facility (DSIF),
comprising two stations at Goldstone, California and two in Aus-
tralia. The two types of data taken during the intervals of time
preceding and following the occultation of the spacecraft consisted
of the received spacecraft signal, processed through two types of
receiver systems which are briefly described. Methods of reduc-
ing the audio recorded and phase lock data are discussed, and
associated computer programs are described. Some results of
their application are presented.   F.R.L.

A66-18054

A66-18054
WATER VAPOR IN THE ATMOSPHERE OF VENUS.
Murk Bottema, William Plummer, and John Strong (Johns Hopkins
University, Laboratory of Astrophysics and Physical Meteorology,
Baltimore, Md.).
Ruimtevaart, vol. 14, Dec. 1965, p. 197, 198.
USAF-supported research.
Determination of the water vapor content in the atmosphere of
Venus above the reflecting cloud layer using an automatic daytime
telescope with an aperture of 30 cm carried aloft by a balloon to
an altitude of 26.5 km. Radiation was measured in the band at
1.13 μ with a grating spectrometer of 2-$\overset{\circ}{A}$ resolving power. This
portion of the spectrum was scanned once every 10 sec with a set of
21 exit slits arrayed to match 21 water absorption-line groups.
Based on the experimental evidence of 120 recordings, it is found
that water content on Venus is the same as that produced by
9.8×10^{-3} gm/cm^2 of water vapor at atmospheric pressure. The
interpretation of the measured absorption requires certain assump-
tions about the pressures to be expected at and above the Venus
cloud top level and the distribution of water vapor in this region.
D.P.F.

A66-18055
COMPOSITION OF THE CLOUDS OF VENUS.
Murk Bottema, William Plummer, John Strong, and Rodolphe
Zander (Johns Hopkins University, Laboratory of Astrophysics
and Physical Meteorology, Baltimore, Md.).
Ruimtevaart, vol. 14, Dec. 1965, p. 198, 199.
USAF-supported research.
Measurements of the reflection spectrum of the clouds in the
atmosphere of Venus covering the 1.7 to 3.4 μ region, with a re-
solving power of about 0.08 μ, using a 30-cm-aperture telescope
carried aloft by a helium balloon to an altitude of 26.2 km. The
telescope was directed toward Venus by offset sun tracking and
automatic guiding. A coarse grating was used to produce a low-
dispersion spectrum; a germanium filter was used to isolate the
first order, and the energy fell upon three adjacent indium arsenide
detectors. The observations were extended over a period of 3-1/4 hr.
Based upon the results of a comparison between the observational
data and the reflection spectra of liquid water, ice, and other mate-
rials at various temperatures in the laboratory, it is concluded that
the reflecting cloud layer of Venus is composed of particles of
frozen water.
D.P.F.

A66-18788
MEASUREMENTS OF MARS AT λ 3.75 CM FROM FEBRUARY TO
JUNE, 1965.
W. A. Dent, M. J. Klein, and H. D. Aller (Michigan, University,
Radio Astronomy Observatory, Ann Arbor, Mich.).
Astrophysical Journal, vol. 142, Nov. 15, 1965, p. 1685-1688. 9 refs
Contract No. Nonr-1224(61).
Discussion of a series of observations made to obtain a more
accurate brightness-temperature measurement of Mars and to place
an upper limit to the variation of the brightness temperature with
planetary phase. A possible variation of the Martian disk tempera-
ture with phase was investigated by computing the daily average
temperatures and tabulating them. These data are plotted as a func-
tion of planetocentric phase angle.
M.M.

A66-18987 #
LONG LIFETIME ORBITS ABOUT MARS.
Richard L. Moll and Martin A. Krop (Lockheed Aircraft Corp.,
Lockheed Missiles and Space Co., Aerospace Sciences Laboratory,
Palo Alto, Calif.).
American Institute of Aeronautics and Astronautics, Aerospace
Sciences Meeting, 3rd, New York, N.Y., Jan. 24-26, 1966,
Paper 66-35. 16 p. 8 refs.
Members, $0.50; nonmembers, $1.00.
Atmospheric drag, solar gravitational perturbations, planetary
oblateness, and other perturbations that affect the lifetime of a Mars
orbiter satellite are described. Their influence upon realistic missio
trajectory selection is analyzed for an orbiter having at least a
fifty-year lifetime. Satellite lifetime estimates based on several
atmospheric models for a wide range of pericenter heights and
orbital eccentricities indicate that drag effects are significant only
for very low orbits. Solar gravitational perturbations on orbits

with moderate to high eccentricity can cause significant changes in
pericenter height for certain orientations of the satellite orbit,
potentially lowering it sufficiently to drastically shorten the lifetime,
or raising it and increasing the satellite's lifetime. While Martian
oblateness does not affect the pericenter height directly, it can, by
acting as a secondary effect, radically alter the character of the
solar perturbation. Low inclination orbits tend to minimize these
changes. However, the initial plane of a Martian satellite can be
so selected that the solar perturbations increase the pericenter
altitude to a large extent over most, if not all, of the mission.
(Author)

A66-19072 #
INTERPRETATION OF LOW RESOLUTION SPECTRA OF MARS
IN THE 2 μ REGION.
L. D. Gray (California, University, Dept. of Engineering, Los
Angeles, Calif.).
American Institute of Aeronautics and Astronautics, Aerospace
Sciences Meeting, 3rd, New York, N.Y., Jan. 24-26, 1966,
Paper 66-147. 12 p. 29 refs.
Members, $0.50; nonmembers, $1.00.
Observation of the carbon dioxide absorption bands located at
2 μ in the atmosphere of Mars. At a given temperature the trans-
mission of these bands is a function only of the product mp, where
m is the amount of CO_2 and p is the "effective" surface pressure.
The random Elsasser band model is used to calculate the transmis-
sion of the 2-μ bands both for homogeneous path lengths and for real
atmospheric paths where the temperature and pressure vary con-
tinuously. The calculated transmission is in excellent agreement
with published laboratory measurements and with the transmission
observed for the earth's atmosphere. Agreement with observations
of the transmission of the Martian atmosphere is obtained using
values of mp = 500 ± 100 m-atm-mb for one "air" mass. The best
current estimates indicate the amount of CO_2 in the atmosphere
of Mars is 60 to 85-m-atm. If the amount is 85 m-atm, the cal-
culations described indicate an atmosphere of pure CO_2 and a sur-
face pressure of 6 mb. If m = 60 m-atm, agreement with experi-
mental data can be obtained for various model atmospheres covering
the range 42% CO_2, 58% Ar, with a surface pressure of 10 mb, to
100% CO_2, with a surface pressure of 4.4 mb. Thus the Martian
surface pressure appears to be in the range of 4 to 10 mb. M.F.

A66-19262
STABILITY OF SULFUR COMPOUNDS ON VENUS.
Robert F. Mueller (Chicago, University, Dept. of Geophysical
Sciences, Chicago, Ill.).
Icarus, vol. 4, Dec. 1965, p. 506-512. 23 refs.
NSF Grant No. GP-2062.
The abundances of the major sulfur compounds in the lower
atmosphere of Venus have been calculated assuming equilibrium
between the atmospheric gases and the mineral phases $CaSO_4$,
$CaSiO_3$, SiO_2, Fe_3O_4, FeS, and FeS_2. Various combinations of
these phases form stable assemblages under different conditions
of oxidation while certain other assemblages are excluded. By
analogy with Earth, it is expected that iron will be more abundant
than sulfur in the Venus crust, and this should result in iron com-
pounds controlling the degree of oxidation as well as the abundances
of the sulfur compounds. Maximum surface fugacities in atmo-
spheres for the major sulfur species at the mean temperature of
700°K and all oxidation conditions are as follows: P_{S_2} ~10^{-3},
P_{SO_2}~$10^{1.6}$, P_{SO_3}~10^{-6}, and P_{H_2S}~$10^{-2.5}$ with P_{H_2S} the least
certain of these values. A further critique of some existing views
on the atmospheric chemistry of Venus is also presented, and it is
concluded that these views are in contradiction with existing observa-
tional data and the theory of the interaction model.
(Author)

A66-19322
PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval' (Akademiia Nauk Ukrainskoi SSR, Glavnaia
Astronomicheskaia Observatoriia, Kiev, Ukrainian SSR).
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i
Marsa, Kiev, Ukrainian SSR, June 1964.)
Kiev, Izdatel'stvo Naukova Dumka, 1965. 168 p. In Russian.

CONTENTS:

A66-19323 #
SPECTROSCOPIC STUDIES OF THE COMPOSITION OF THE CYTHEREAN ATMOSPHERE [SPEKTROSKOPICHESKIE ISSLE-DOVANIIA SOSTAVA ATMOSFERY VENERY].
V. K. Prokof'ev (Akademiia Nauk SSSR, Krymskaia Astrofizicheskaia Observatoriia, Partizanskoye, Ukrainian SSR).
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i Marsa, Kiev, Ukrainian SSR, June 1964.)
IN: PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval'.
Kiev, Izdatel'stvo Naukova Dumka, 1965, p. 6-11. In Russian.

Discussion of a possible composition of the atmosphere of Venus in the light of available spectral data. Theories concerning nitrogen as a likely basic component are presented and observations are noted that give some slight evidence for the presence of oxygen and water vapor on Venus. The possible existence of traces of formaldehyde is indicated.   V. Z.

A66-19324 #
SOME ASPECTS OF THE IONOSPHERIC HYPOTHESIS FOR RADIO EMISSION FROM VENUS [K VOPROSU OB IONOSFERNOI GIPOTEZE RADIOIZLUCHENIIA VENERY].
A. D. Danilov and S. P. Iatsenko (Glavnoe Upravlenie Gidrometeoro-logicheskoi Sluzhby, Institut Prikladnoi Geofiziki, Moscow, USSR).
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i Marsa, Kiev, Ukrainian SSR, June 1964.)
IN: PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval'.
Kiev, Izdatel'stvo Naukova Dumka, 1965, p. 14-20. 15 refs.
In Russian.

Discussion of Strelkov's theory of radio emission from Venus that holds radioactive heating of the planet's surface to be the cause of the high temperature of its radiation in the centimeter band. This theory is viewed more favorably than others - e.g., the ionospheric, "greenhouse," or neon theory (Suess) - since it does not require the hypothesis of a strong greenhouse effect or a strong ionosphere with the attendant difficulties.   V. Z.

A66-19325 #
EFFECT OF THE CLOUD COVER OF VENUS ON THE PLANET'S RADIO EMISSION IN THE CENTIMETER AND MILLIMETER RANGE [O VLIIANII OBLACHNOGO POKROVA VENERY NA EE RADIOIZLUCHENIE V SANTIMETROVOM I MILLIMETROVOM DIAPAZONAKH VOLN].

G. M. Strelkov (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR).
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i Marsa, Kiev, Ukrainian SSR, June 1964.)
IN: PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval'.
Kiev, Izdatel'stvo Naukova Dumka, 1965, p. 21-46. 58 refs.
In Russian.
Development of an atmospheric model of Venus with a chemical composition and a vertical profile of pressure and temperature based on astronomical observations at radio frequencies and in the visible and near IR spectral bands. The spectral characteristics of the planet's radio brightness temperature are given a thorough theoretical analysis. The theoretical and experimental values of these characteristics are compared in order to verify the validity of the model.   V. Z.

A66-19327 #
OPTICAL PROPERTIES OF THE MARTIAN ATMOSPHERE AC-CORDING TO THE RESULTS OF PHOTOMETRIC OBSERVATIONS [OPTICHESKIE SVOISTVA ATMOSFERY MARSA PO DANNYM FOTOMETRICHESKIKH NABLIUDENII].
N. P. Barabashov (Khar'kovskii Gosudarstvennyi Universitet, Astronomicheskaia Observatoriia, Kharkov, Ukrainian SSR).
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i Marsa, Kiev, Ukrainian SSR, June 1964.)
IN: PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval'.
Kiev, Izdatel'stvo Naukova Dumka, 1965, p. 52-60. 15 refs.
In Russian.
Analysis of the results of photometric observations of Mars carried out on the basis of the theory of light scattering in planetary atmospheres. It is shown that the optical thickness of the Martian atmosphere is most probably low and that this atmosphere possesses chiefly scattering properties in the visible part of the spectrum. The true absorption is found to increase in the short-wave part of the spectrum, although the optical thickness of the atmosphere is relatively small in this case too. Many areas in the maria are found to have a greenish tint.   A. B. K.

A66-19328 #
CERTAIN REMARKS ON HYPOTHESES OF AN ABSORBING ATMO-SPHERE ON MARS [NEKOTORYE ZAMECHANIIA PO VOPROSU O GIPOTEZAKH POGLOSHCHAIUSHCHEI ATMOSFERY NA MARSE].
V. V. Sharonov.
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i Marsa, Kiev, Ukrainian SSR, June 1964.)
IN: PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval'.
Kiev, Izdatel'stvo Naukova Dumka, 1965, p. 61-71. 28 refs. In Russian.
Critical review of models of the atmosphere and surface of Mars in which the atmosphere is assumed to be absorbing and not scattering, whereby the red color is ascribed to selective absorption in the atmospheric layer. The hypothesis of Carrer and the Kiesses, ascribing selective extinction to the presence of nitrous oxide in the Martian atmosphere, is said to be unacceptable in view of the fact that the absorption band of this compound in the planet's spectrum is absent or very weak. Kozyrev's conception is said to be contradicted by the observed brightness distribution along the

A66-19329 #
MODEL OF THE ATMOSPHERE AND SURFACE OF MARS FROM THE STANDPOINT OF A PURELY SCATTERING ATMOSPHERE [MODEL' ATMOSFERY I POVERKHNOSTI MARSA S TOCHKI ZRENIIA GIPOTEZY CHISTO RASSEIVAIUSHCHEI ATMOSFERY].
V. V. Sharonov.
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i Marsa, Kiev, Ukrainian SSR, June 1964.)
IN: PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval'.
Kiev, Izdatel'stvo Naukova Dumka, 1965, p. 72-78. 13 refs.
In Russian.

Review of the current state of the problem of applying photo-metric data to the clarification of the nature of Mars. A principle for selecting a model of the atmosphere and surface of Mars is proposed, according to which the models closest to terrestrial conditions are considered as most probable. From this standpoint, a model in which the visible part of the spectrum of the atmosphere is assumed to be purely scattering, while the surface is covered with limonitic dust is regarded as being most probable.   A. B. K.

A66-19330 #
CERTAIN CONSIDERATIONS CONCERNING THE AEROSOL COM-PONENT OF THE MARTIAN ATMOSPHERE [NEKOTORYE SOOBRAZHENIIA PO POVODU AEROZOL'NOI SOSTAVLIAIUSHCHEI ATMOSFERY MARSA].
N. N. Sytinskaia (Leningradskii Gosudarstvennyi Universitet, Astronomicheskaia Observatoriia, Leningrad, USSR).
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i Marsa, Kiev, Ukrainian SSR, June 1964.)
IN: PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval'.
Kiev, Izdatel'stvo Naukova Dumka, 1965, p. 79-81. In Russian.
Discussion of certain problems arising in connection with the need to separate the gas and aerosol components in the brightness of the atmospheric layer in the case of photometrically obtained data pertaining to the Martian atmosphere. It is pointed out that, since no sufficiently reliable methods have been proposed for this separation, it would be interesting to reverse the problem and, using the pressure values determined by other methods, study the content of the suspended particles photometrically.   A. B. K.

A66-19331 #
AEROSOL COMPONENT OF THE ATMOSPHERE OF MARS [OB AEROZOL'NOI SOSTAVLIAIUSHCHEI ATMOSFERY MARSA].
E. G. Ianovitskii (Akademiia Nauk Ukrainskoi SSR, Glavnaia Astronomicheskaia Observatoriia, Kiev, Ukrainian SSR).
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i Marsa, Kiev, Ukrainian SSR, June 1964.)
IN: PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval'.
Kiev, Izdatel'stvo Naukova Dumka, 1965, p. 82-90. 18 refs.
In Russian.
Explanation of the difference between the values obtained for atmospheric pressure at the Martian surface obtained from photo-metric and polarimetric observations and those obtained by spectroscopic means. It is suggested that the difference arises because the error due to light scattering by aerosol particles with radii $r < 10^{-6}$ cm is not taken into account in photo- and polarimetric observations. The number of aerosol particles of radii on the order of 10^{-6} cm in a column of the Martian atmosphere with a base of 1 cm^2 is 10^{15} cm^{-2}. It is shown that the saturation of the Martian atmosphere with fine aerosol particles per unit mass of atmosphere is much higher than that of the earth's atmosphere.   R. A. F.

A66-19332 #
BRIEF ANALYSIS OF A PHOTOMETRIC STUDY OF THE BRIGHT-NESS DISTRIBUTION ALONG THE DISK OF MARS [KRATKII ANALIZ FOTOMETRICHESKOGO IZUCHENIIA RASPREDELENIIA IARKOSTI PO DISKU MARSA].
I. K. Koval' (Akademiia Nauk Ukrainskoi SSR, Glavnaia Astronomicheskaia Observatoriia, Kiev, Ukrainian SSR).
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i Marsa, Kiev, Ukrainian SSR, June 1964.)
IN: PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval'.
Kiev, Izdatel'stvo Naukova Dumka, 1965, p. 94-98. 9 refs.
In Russian.
Analysis of investigations of Martian limb darkening. It is noted that the great amount of accumulated photometric data is of low accuracy due to the observers' failure to allow for the effect of image vibration. It is therefore difficult to use these data for a study of the variations in the aerosol component of the Martian atmosphere.   R. A. F.

A66-19333 #
CHECK ON THE HYPOTHESIS OF THE LIMONITIC COVER OF
MARS BY SPECTROPHOTOMETRIC DATA [PROVERKA GIPOTEZY
LIMONITOVOGO POKROVA NA MARSE PO DANNYM SPEKTRO-
FOTOMETRII].
L. I. Lebedeva (Leningradskii Gosudarstvennyi Universitet, Astro-
nomicheskaia Observatoriia, Leningrad, USSR).
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i
Marsa, Kiev, Ukrainian SSR, June 1964.)
IN: PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval'.
Kiev, Izdatel' stvo Naukova Dumka, 1965, p. 99-104. 19 refs.
In Russian.
    Comparison of the spectral reflecting power curve (corrected
for atmospheric effects) for the continents in the center of the Martian
disk with the same curves for terrestrial samples. Observations
were made at the Astronomical Observatory of the Leningrad State
University, in the 380- to 900-mμ range. The spectral reflecting
power curve of limonite is seen to be fairly similar to that obtained
for the continents of Mars.   R.A.F.

A66-19337 #
DETERMINATION OF THE OPTICAL PARAMETERS OF THE
MARTIAN ATMOSPHERE AND SURFACE TAKING INTO ACCOUNT
ANISOTROPIC SCATTERING [OB OPREDELENII OPTICHESKIKH
PARAMETROV ATMOSFERY I POVERKHNOSTI MARSA PRI
UCHETE ANIZOTROPII RASSEIANIIA].
A. V. Morozhenko and E. G. Ianovitskii (Akademiia Nauk Ukrainskoi
SSR, Glavnaia Astronomicheskaia Observatoriia, Kiev, Ukrainian
SSR).
(Soveshchanie Rabochei Gruppy po Issledovaniiu Atmosfer Venery i
Marsa, Kiev, Ukrainian SSR, June 1964.)
IN: PROBLEMS OF ASTROPHYSICS [VOPROSY ASTROFIZIKI].
Edited by I. K. Koval'.
Kiev, Izdatel' stvo Naukova Dumka, 1965, p. 127-131. 10 refs.
In Russian.
    Determination of the optical parameters of the Martian atmo-
sphere and surface from absolute photometric data both for spherical
and elongated scattering indicatrices. A comparison of the optical
parameters for some values of the indicatrices shows a marked
increase in optical thickness and slight variations in the surface
albedos for the more elongated indicatrices when the albedo of a
single scattering event is near unity. Tables of numerical values
of the optical parameters are included.   V. Z.

A66-19457 #
MEASUREMENTS OF THE BRIGHTNESS TEMPERATURE ON THE
ILLUMINATED SIDE OF VENUS AT 10. 6 CM [IZMERENIIA IARKO-
STNOI TEMPERATURY OSVESHCHENNOI STORONY VENERY NA
VOLNE 10. 6 CM].
A. D. Kuz'min (Akademiia Nauk SSSR, Fizicheskii Institut, Moscow,
USSR).
Astronomicheskii Zhurnal, vol. 42, Nov. -Dec. 1965, p. 1281-1286.
19 refs. In Russian.
    Results of measurements at 10. 6 cm of the brightness tempera-
ture, averaged across the planet's visible disk, of Venus approaching
its superior conjunction (k = 0. 84). The brightness temperature is
given as 550°K, and it is shown that at this frequency its values on
both the illuminated and the dark sides of the planet are equal,
within the experimental accuracy of 5% - i.e., its phase variation
does not exceed 2. 5%. This result disagrees with the results of
other authors at 3.15 cm and challenges Troitskii's theory of radia-
tion emission by the planet's surface.   V. Z.

A66-19592
JUPITER'S GREAT RED SPOT.
Wendell C. DeMarcus (Kentucky, University, Dept. of Physics,
Lexington, Ky.) and Rupert Wildt (Yale University, Observatory,
New Haven, Conn.).
Nature, vol. 209, Jan. 1, 1966, p. 62. 9 refs.
    Description of a possible explanation for the great red spot on
the surface of Jupiter. It is suggested that the red spot is a region

where separation occurs between two distinct phases of the multi-
component atmosphere which have the same density but different
compositions. The "red spot phase" would be buoyantly neutral
with respect to its surroundings - a thermodynamic Cartesian diver.
Possible hydrodynamic effects of separation between fluid phases
in a multicomponent gas are discussed.   P.K.

A66-19793 #
POSITION OF THE EQUATORIAL BOUNDARY OF ABNORMAL
IONIZATION OCCURRENCE FOR VARIOUS LEVELS OF PLANE-
TARY MAGNETIC ACTIVITY [POLOZHENIE EKVATORIAL'NOI
GRANITSY OBLASTI POIAVLENIIA ANOMAL'NOI IONIZATSII
V ZAVISIMOSTI OT PLANETARNOI MAGNITNOI AKTIVNOSTI].
L. A. Iudovich (Akademiia Nauk SSSR, Institut Zemnogo Mag-
netizma, Ionosfery i Rasprostraneniia Radiovoln, Krasnaya
Pakhra, USSR).
Geomagnetizm i Aeronomiia, vol. 5, Nov. -Dec. 1965, p. 1113, 1114.
In Russian.
    Brief note on a determination of the position of the equatorial
boundary of abnormally high nocturnal atmospheric ionization for
various levels of planetary magnetic activity. The study was con-
ducted to obtain more reliable statistical data than those available
in the literature; it was based on observations of ionization along
three strings of meridionally located stations in the Western and
Eastern Hemispheres and in the Antarctics, taken from Nov. 1957
to Feb. 1958, in Nov. and Dec. 1958, and from May to Aug. 1958,
respectively.   V. Z.

A66-20101
SYMPOSIUM ON PLANETARY ATMOSPHERES AND SURFACES,
DORADO, PUERTO RICO, MAY 24-27, 1965, PROCEEDINGS.
Symposium sponsored by the International Scientific Radio Union.
Journal of Research, Section D - Radio Science, vol. 69D, Dec.
1965. 188 p.

CONTENTS:

A REPORT OF MEASUREMENTS. D. Barber (Ministry ov Aviation, Great Malvern, England) and J. F. R. Gower (Mullard Radio Astronomy Observatory, Cambridge, England), p. 1563.

PASSIVE RADIO OBSERVATIONS OF VENUS, SATURN, MERCURY, MARS, AND URANUS.
PASSIVE RADIO OBSERVATIONS OF MERCURY, VENUS, MARS, SATURN, AND URANUS. Alan H. Barrett (Massachusetts Institute of Technology, Cambridge, Mass.), p. 1565-1573. 41 refs. [See A66-20109 09-30]
MARS AND VENUS AT 70-CM WAVELENGTH. H. E. Hardebeck (Cornell University, Ithaca, N.Y.), p. 1573.
RADIO OBSERVATIONS OF MERCURY, VENUS, MARS, SATURN, AND URANUS. Kenneth I. Kellermann (Commonwealth Scientific and Industrial Research Organization, Sydney, Australia), p. 1574, 1575. 10 refs. [See A66-20110 09-30]
THE OBSERVATIONS OF RADIO EMISSION FROM THE PLANET MERCURY, MARS, AND SATURN AT WAVELENGTH OF 8 MM. A. E. Salomonovich (Academy of Sciences, Moscow, USSR), p. 1576.
A SEARCH FOR THE 1.36-CM WATER-VAPOR LINE IN VENUS. F. D. Drake (Cornell University, Ithaca, N.Y.), p. 1577.
RADIATION OF VENUS AT THE 13.5-MM WATER-VAPOR LINE. J. E. Gibson and H. H. Corbett (U.S. Naval Research Laboratory, Washington, D.C.), p. 1577-1579. [See A66-20111 09-30]
OBSERVATIONS OF THE 1.35-CM WATER-VAPOR LINE IN VENUS. W. J. Welch (California, University, Berkeley, Calif.), p. 1580.
OBSERVATIONS OF MARS AT 12.5-CM WAVELENGTH. D. O. Muhleman and T. Sato (California Institute of Technology, Pasadena Calif.), p. 1580.
ON THE NATURE OF THE CLOUD LAYER OF VENUS - FROM RADIOMETRIC OBSERVATIONS AT MICROWAVES. A. E. Basharinov and B. G. Kutuza (Academy of Sciences, Moscow, USSR), p. 1580-1583. 11 refs. [See A66-20112 09-30]
AN ANALYSIS OF MICROWAVE OBSERVATIONS OF VENUS. Carl Sagan (Harvard University; Smithsonian Astrophysical Observatory, Cambridge, Mass.) and James B. Pollack (Smithsonian Institution, Cambridge, Mass.), p. 1583, 1584. 5 refs. [See A66-20113 09-30]
PASSIVE RADIO OBSERVATIONS OF THE MOON.
INVESTIGATION OF THE SURFACES OF THE MOON AND PLANETS BY THE THERMAL RADIATION. V. S. Troitsky (Gorki State University, Gorki, USSR), p. 1585-1612. 95 refs. [See A66-20114 09-30]
POLARIZATION OF THERMAL RADIATION OF THE MOON AT 14.5 GC/S. P. G. Mezger (National Radio Astronomy Observatory, Green Bank, W. Va.), p. 1612.
LINEAR POLARIZATION OF LUNAR EMISSION. R. D. Davies and F. F. Gardner (Commonwealth Scientific and Industrial Research Organization, Sydney, Australia), p. 1613.
THE EFFECT OF ROUGHNESS ON THE POLARIZATION OF THERMAL EMISSION FROM A SURFACE. T. Hagfors and J. Moriello (Massachusetts Institute of Technology, Cambridge, Mass.), p. 1614, 1615. [See A66-20115 09-23]
MEASUREMENTS OF LUNAR RADIO BRIGHTNESS DISTRIBUTION AND CERTAIN PROPERTIES OF ITS SURFACE LAYER. A. E. Salomonovich (Academy of Sciences, Moscow, USSR), p. 1616.

RADAR OBSERVATIONS OF THE PLANETS.
A REVIEW OF RADAR STUDIES OF PLANETARY SURFACES. G. H. Pettengill (Cornell-Sydney University Astronomy Center, Arecibo, Puerto Rico), p. 1617-1623. 29 refs. [See A66-20116 09-30]
PRELIMINARY VENUS RADAR RESULTS. Richard M. Goldstein (California Institute of Technology, Pasadena, Calif.), p. 1623-1625. [See A66-20117 09-30]
PRELIMINARY MARS RADAR RESULTS. Richard M. Goldstein (California Institute of Technology, Pasadena, Calif.), p. 1625-1627. [See A66-20118 09-30]
RECENT ARECIBO OBSERVATIONS OF MERCURY. G. H. Pettengill (Cornell-Sydney University Astronomy Center, Arecibo, Puerto Rico), p. 1627, 1628. [See A66-20119 09-30]
RECENT ARECIBO OBSERVATIONS OF MARS AND JUPITER. R. B. Dyce (Cornell-Sydney University Astronomy Center, Arecibo, Puerto Rico), p. 1628, 1629. [See A66-20120 09-30]
RADIO EVIDENCE ON THE STRUCTURE AND COMPOSITION

OF THE MARTIAN SURFACE. Carl Sagan (Harvard University; Smithsonian Astrophysical Observatory, Cambridge, Mass.) and James B. Pollack (Smithsonian Astrophysical Observatory, Cambridge, Mass.), p. 1629.
RADAR SCATTERING FROM VENUS AND MERCURY AT 12.5 CM. Duane O. Muhleman (California Institute of Technology, Pasadena, Calif.), p. 1630, 1631. [See A66-20121 09-30]
APPLICATION OF PLANETARY MEASUREMENTS TO PLANETARY RADIUS AND ROTATION RATE DETERMINATIONS. Irwin I. Shapiro (Massachusetts Institute of Technology, Cambridge, Mass.), p. 1632, 1633. [See A66-20122 09-30]
RADAR OBSERVATIONS OF VENUS IN THE SOVIET UNION IN 1964. V. A. Kotelnikov (Academy of Sciences, Moscow, USSR), p. 1634-1636. [See A66-20123 09-30]
RADAR OBSERVATIONS OF THE MOON.
RADAR STUDIES OF THE MOON. J. V. Evans (Massachusetts Institute of Technology, Lexington, Mass.), p. 1637-1659. 69 refs. [See A66-20124 09-30]
DECAMETER-WAVE RADAR STUDIES OF THE LUNAR SURFACE. J. R. Davis, D. C. Rohlfs, G. A. Skaggs, and J. W. Joss (U.S. Naval Research Laboratory, Washington, D.C.), p. 1659-1667. 10 refs. [See A66-20125 09-30]
LUNAR MAPPING BY COHERENT-PULSE ANALYSIS. T. W. Thompson (Cornell-Sydney University Astronomy Center, Arecibo, Puerto Rico), p. 1667-1669. [See A66-20126 09-30]
INTERPRETATION OF THE ANGULAR DEPENDENCE OF BACKSCATTERING FROM THE MOON AND VENUS. Petr Beckmann (Colorado, University, Boulder, Colo.) and W. K. Klemperer (National Bureau of Standards, Boulder, Colo.), p. 1669-1677. 16 refs. [See A66-20127 09-30]
A NOTE ON THE RADIO REFLECTIVITY OF THE LUNAR SURFACE. A Giraud (Centre National d'Etudes des Télécommunications, Issy-les-Moulineaux, Seine, France), p. 1677-1681. 16 refs. [See A66-20128 09-30]
MOON DISTANCE MEASUREMENT BY LASER. A. Orszag (Ecole Polytechnique, Paris, France), p. 1681-1689. 12 refs. [See A66-20129 09-30]
SOME HIGHLIGHTS OF THE URSI SYMPOSIUM ON ELECTROMAGNETIC WAVE THEORY HELD IN DELFT, THE NETHERLANDS, SEPTEMBER 6-11, 1965. James R. Wait (National Bureau of Standards, Boulder, Colo.), p. 1691-1693.
INDEX TO VOLUME 69D, p. 1695-1700.

A66-20111 #
RADIATION OF VENUS AT THE 13.5-MM WATER-VAPOR LINE. J. E. Gibson and H. H. Corbett (U.S. Naval Research Laboratory, E. O. Hulburt Center for Space Research, Washington, D.C.).
(Symposium on Planetary Atmospheres and Surfaces, Dorado, Puerto Rico, May 24-27, 1965, Paper.)
Journal of Research, Section D - Radio Science, vol. 69D, Dec. 1965, p. 1577-1579.
Investigation of the brightness variation of Venus between previously observed wavelengths of 8.6 mm and 3.15 cm, with special interest in the possibility that the 13.5-mm water-vapor absorption maximum might give evidence of water vapor in the atmosphere of Venus. Also investigated is the existence of any variation in planetary brightness with phase of solar illumination. The first group of measurements were on 21 occasions between Oct. 29, 1962, and Feb. 9, 1963 and the second group gave eight measurements between Apr. 26 and June 26, 1964. The results indicated that at a wavelength of 13.5 mm the average disk brightness temperature of Venus is essentially constant at 430 to 440°K over a phase variation of 45 to 50° each side of lower conjunction, but at greater phase angles up to the limit of measurement just beyond dichotomy the brightness rapidly increases approximately linearly with the fraction of the disk illuminated.   M.F.

A66-20112 #
ON THE NATURE OF THE CLOUD LAYER OF VENUS - FROM RADIOMETRIC OBSERVATIONS AT MICROWAVES.
A. E. Basharinov and B. G. Kutuza (Academy of Sciences, Institute for Radioengineering and Electronics, Moscow, USSR).
(Symposium on Planetary Atmospheres and Surfaces, Dorado, Puerto Rico, May 24-27, 1965, Paper.)
Journal of Research, Section D - Radio Science, vol. 69D, Dec. 1965, p. 1580-1583. 11 refs.

Discussion of the nature of the cloud layer of Venus while interpreting optical observations and radio brightness temperature data obtained for the nocturnal side of the planet. The hypothetical presence of supercooled water drops in the cloud layer of Venus has been checked by extrapolating the 8-mm wave absorption value, obtained from phase variation of radio brightness temperatures, into millimeter and centimeter wave ranges. It has been shown that the extrapolated values of the radio brightness temperature spectrum are in satisfactory agreement with the radio brightness temperature values measured at the nocturnal side of Venus. The content of water in the cloud layer is estimated to be about 0.2 to 0.3 g/cm^2, the absorption in the layer not exceeding 1.5 db in the centimeter range and being not above 5 db in the millimeter range for a wavelength of above 3 mm.   M. F.

A66-20116 #
A REVIEW OF RADAR STUDIES OF PLANETARY SURFACES.
G. H. Pettengill (Cornell-Sydney University Astronomy Center, Arecibo Ionospheric Observatory, Arecibo, Puerto Rico).
(Symposium on Planetary Atmospheres and Surfaces, Dorado, Puerto Rico, May 24-27, 1965, Paper.)
Journal of Research, Section D - Radio Science, vol. 69D, Dec. 1965, p. 1617-1623. 29 refs.
In recent years, radar has been used to study the surfaces of the planets Mercury, Venus, Mars, and Jupiter. In the case of Venus, attenuation in the planetary atmosphere at short wavelengths has also been reported. For Mercury and Venus, where the diurnal rotation is difficult to establish by other means, radar has provided a clear-cut determination of the sidereal periods as 59 and 247 days, respectively. Mercury is found to possess surface conditions not unlike those on the moon. Venus appears to have a surface considerably denser and smoother than the moon, but displaying several localized regions of scattering enhancement. Mars appears smoother than the other planets, with a marked degree of surface differentiation. Except for one brief period of observation in 1963, Jupiter appears exceedingly inefficient as a reflector of decimetric radio energy.   (Author)

A66-20181
MARINER IV - DEVELOPING THE SCIENTIFIC EXPERIMENT.
Glenn A. Reiff (NASA, Office of Space Science and Applications, Washington, D.C.).
Science, vol. 151, Jan. 28, 1966, p. 413-417. 13 refs.
Account of some of the experiences associated with the development of the scientific payload for the flight of Mariner 4 (1964 77A). Steps taken to combine the scientific instruments with the other vital elements of the spacecraft are summarized. An equipment-test matrix, a chart of the phasing of the project, and a block diagram of the parts-control program are included.   R. A. F.

A66-20182
MERCURY- ANOMALOUS ABSENCE FROM THE 3.4-MILLIMETER RADIO EMISSION OF VARIATION WITH PHASE.
Eugene E. Epstein (Aerospace Corp., El Segundo, Calif.).
Science, vol. 151, Jan. 28, 1966, p. 445-447. 7 refs.
Contract No. AF 04(695)-669.
Discussion of unusual results from some radio observations of the planet Mercury. Radio observations of Mercury at 3.4 mm from July to Oct. 1965 showed brightness temperatures of only about 200°K, even when major fractions of the planet's illuminated hemisphere were observed. There was no significant variation with phase. Possible reasons for this anomaly are briefly considered.   R. A. F.

A66-20287
PLANETARY ENVIRONMENTS.
Roger A. Van Tassel and John W. Salisbury (USAF, Office of Aerospace Research, Cambridge Research Laboratories, Bedford, Mass.).
IN: HANDBOOK OF GEOPHYSICS AND SPACE ENVIRONMENTS.
Edited by S. L. Valley.
New York, McGraw-Hill Book Co., 1965, p. 20-1 to 20-19. 40 refs.
Speculative discussion of planetary environments. It is noted that models which satisfy all the observations are not available and

that, therefore, except for Mars and Venus, only brief descriptions and tabular data are given. It is pointed out that unless a source of the tabular data is designated, the values quoted are from the Smithsonian Physical Tables.   M. M.

A66-20289
RADIO ASTRONOMY.
N. H. Dieter, J. P. Castelli, and D. W. Ushakoff (USAF, Office of Aerospace Research, Cambridge Research Laboratories, Bedford, Mass.).
IN: HANDBOOK OF GEOPHYSICS AND SPACE ENVIRONMENTS.
Edited by S. L. Valley.
New York, McGraw-Hill Book Co., 1965, p. 22-1 to 22-15. 16 refs.
Discussion of radio astronomy, the branch of astronomy concerned with the passive reception of radiation in radio wavelengths from extraterrestrial sources. Fundamental concepts and definitions are given. The effects of the earth's atmosphere discussed include refraction, scintillation and absorption. Radio emission from the moon and from the planets Venus, Mars, Jupiter, Saturn, and Mercury is evaluated, and sources of radio emissions are reviewed. It has been found that the five brightest discrete sources are Cassiopeia A, Cygnus A, Taurus A, Virgo A, and Centaurus A. The positions and angular diameters, the flux density vs the frequency, and the spectrum of these five discrete sources are tabulated.   M. F.

A66-20291
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY. VOLUME 3 (Numbers 52-57).
Tucson, University of Arizona Press, 1965. 42 p.

CONTENTS:
ATMOSPHERIC EXTINCTION CORRECTIONS IN THE INFRARED. H. L. Johnson (Arizona, University, Tucson, Ariz.), p. 67-71. [See A66-20292 09-13]
THE ABSOLUTE CALIBRATION OF THE ARIZONA PHOTOMETRY. H. L. Johnson (Arizona, University, Tucson, Ariz.), p. 73-77. 24 refs. [See A66-20293 09-23]

A66-20660 #
THE PLANET MARS [LA PLANETE MARS].
Gérald Goy.
Sciences et Industries Spatiales, vol. 2, no. 1-2, 1966, p. 69-74.
In French.
Analysis of Mariner 4 photographs, including a discussion of the superficial characteristics of the planet Mars: topography, soil composition, periodically observed phenomena, atmospheric phenomena, and radiation measurements. Terrestrial atmospheric turbulence, the small angular size of the Martian disk (some 15" of arc in diameter), and the low contrast of the Martian surface combine to make exact photographic observations of this planet extremely onerous. A technique which is based on the superposition of multiple photographic images and which in part overcomes these difficulties is described. The periodic migration of the polar cap from one pole to the other and the accompanying color changes of the Martian surface are described. The presence of H_2O and CO_2 in the Martian atmosphere and the interpretation of the photographs and other data obtained by Mariner 4 are discussed.   D. P. F.

A66-20882
ON THE LOSS OF GASES FROM A PLANETARY ATMOSPHERE.
P. B. Hays and V. C. Liu (Michigan, University, Dept. of Aeronautical and Astronautical Engineering, Ann Arbor, Mich.).
Planetary and Space Science, vol. 13, Dec. 1965, p. 1185-1212. 38 refs.
Research supported by the University of Michigan and Army; Contract No. NASA-54(05).
An analysis of the collisional transition between the lower atmosphere and the collisionless exosphere is carried out based upon an integral formulation of the Boltzmann equation. This investigation utilizes a collision model which is a combination of Lorentz-gas and relaxation collision models. The results of this analysis indicate that intermolecular collisions act in two ways to

affect the atmosphere. First, there is a critical layer, similar to the apparent photospheric surface of the Sun, from which the material escaping from the planet originates. This layer is determined by collision suffered by particles moving on orbits which skim tangentially by the planet. Secondly, collisions reduce the vertical flux of material in a manner analogous to the diffusion processes which occur in the lower atmosphere. (Author)

A66-21065

SPECTROSCOPIC OBSERVATIONS OF MARS.
William O. Davies (Illinois Institute of Technology, Research Institute, Chicago, Ill.).
Frontier, vol. 26, Winter 1965, p. 4-9.
Discussion of spectroscopic attempts to determine the composition of the Martian atmosphere and the pressure of the atmosphere at the planet's surface. The bases of the spectroscopic techniques used for these purposes are described. Current estimates of the composition and surface pressure of Mars' atmosphere are given. The natural limitations imposed upon measurements made from the earth, from balloons, or from satellites of either the earth or Mars are discussed. R.A.F.

A66-21109 #

A QUANTITATIVE MEASUREMENT OF WATER-VAPOR IN THE ATMOSPHERE OF VENUS.
Murk Bottema, William Plummer, and John Strong (Johns Hopkins University, Baltimore, Md.).
(Annales d'Astrophysique, vol. 28, Jan.-Feb. 1965, p. 225-228.)
IN: ASTRONOMICAL OBSERVATIONS FROM SPACE VEHICLES; INTERNATIONAL ASTRONOMICAL UNION, SYMPOSIUM NO. 23, LIEGE, BELGIUM, AUGUST 17-20, 1964, PROCEEDINGS. [A66-21078 10-29]
Symposium supported by the International Astronomical Union and the United Nations Educational, Scientific and Cultural Organization.
Edited by J. L. Steinberg.
Paris, Centre National de la Recherche Scientifique, 1965, p. 275-278.
Contract No. AF 19(628)-202.
[For abstract see issue 12, page 1759, Accession no. A65-22097]

A66-21099 #

AN OBSERVATION OF JUPITER IN THE ULTRAVIOLET.
Theodore P. Stecher (NASA, Goddard Space Flight Center, Greenbelt, Md.).
(Annales d'Astrophysique, vol. 28, July-Aug. 1965, p. 788-790.)
IN: ASTRONOMICAL OBSERVATIONS FROM SPACE VEHICLES; INTERNATIONAL ASTRONOMICAL UNION, SYMPOSIUM NO. 23, LIEGE, BELGIUM, AUGUST 17-20, 1964, PROCEEDINGS. [A66-21078 10-29]
Symposium supported by the International Astronomical Union and the United Nations Educational, Scientific and Cultural Organization.
Edited by J. L. Steinberg.
Paris, Centre National de la Recherche Scientifique, 1965, p. 189-191; Discussion, p. 191. 13 refs.
Study of a single photoelectric spectral scan of Jupiter in the UV reproduced as a plot of geometric reflectivity vs wavelength. The reflectivity is assumed to be due to Rayleigh scattering by molecular hydrogen, and a comparison is made with three model atmospheres of molecular hydrogen. The best fit is obtained with the 10.5 km-atm H_2 model. An upper limit to the amount of molecular hydrogen above the cloud layer of a 11 km atm is derived. The observation was obtained with an objective grating stellar spectrometer on board an Aerobee rocket. M.F.

A66-21110 #

SPACECRAFT OBSERVATION OF VENUS INFRA-RED LIMB-DARKENING.

Carl Sagan (Harvard University; Smithsonian Institution, Smithsonian Astrophysical Observatory, Cambridge, Mass.) and James B. Pollack (Harvard University, Harvard College Observatory, Cambridge, Mass.).
(Annales d'Astrophysique, vol. 28, Jan.-Feb. 1965, p. 229-233.)
IN: ASTRONOMICAL OBSERVATIONS FROM SPACE VEHICLES; INTERNATIONAL ASTRONOMICAL UNION, SYMPOSIUM NO. 23, LIEGE, BELGIUM, AUGUST 17-20, 1964, PROCEEDINGS. [A66-21078 10-29]
Symposium supported by the International Astronomical Union and the United Nations Educational, Scientific and Cultural Organization.
Edited by J. L. Steinberg.
Paris, Centre National de la Recherche Scientifique, 1965, p. 279-283; Discussion, p. 283.
[For abstract see issue 12, page 1759, Accession no. A65-22098]

A66-21201

NOTE ON THERMAL PROPERTIES OF MARS.
C. Leovy (RAND Corp., Santa Monica, Calif.).
Icarus, vol. 5, Jan. 1966, p. 1-6. 12 refs.
Contract No. NASr-21(07).
Interpretation of the variation of infrared emission from the surface of Mars with local time on Mars in terms of a simplified theory of diurnal temperature variations, in which the effect of the atmosphere is included. The results suggest a very low thermal conductivity for the upper few centimeters of the Martian ground. Such low conductivities appear to be possible only if the material composing these layers is very fine powder having a characteristic size of not more than a few microns. If a linear relationship is assumed between convective heat transfer and surface temperature, the appropriate constant of proportionality is on the order of 10^{-4} cal/cm^2-sec-°K. F.R.L.

A66-21202

PHOTOMETRIC SEARCH FOR ATMOSPHERES ON EUROPA AND GANYMEDE.
Alan B. Binder and Dale P. Cruikshank (Arizona, University, Lunar and Planetary Laboratory and Dept. of Geology, Tucson, Ariz.).
Icarus, vol. 5, Jan. 1966, p. 7-9.
Grant No. NsG-161-61.
Results of observations of the eclipse disappearances and reappearances of JII (Europa) and JIII (Ganymede), made in continuation of earlier work, to detect possible atmospheres on these satellites revealed by excess brightness on eclipse reappearance. An observation of an eclipse reappearance of JII with the Kitt Peak 36-in. telescope showed a brightness anomaly of 0.03 ± 0.01 stellar magnitudes. The anomaly decayed in 10 min. Two high-quality observations of JIII showed no brightness anomaly greater than 0.01 stellar magnitudes. F.R.L.

A66-21204

THE GREENHOUSE EFFECT IN A GRAY PLANETARY ATMOSPHERE.
Rupert Wildt (Yale University, Observatory, New Haven, Conn.; NASA, Goddard Space Flight Center, Goddard Institute for Space Studies, New York, N.Y.).
Icarus, vol. 5, Jan. 1966, p. 24-33. 6 refs.
Grant No. NGR-07-004-029.
Illustration of Hopf's analytical solution for several values of the ratio of gray absorption coefficients for insolating and escaping radiation (the greenhouse parameter, n), assumed to be constant at all depths. Three graphs are presented for temperature distribution as a function of optical depth with a zero, moderate, or strong greenhouse effect for flux incident at various angles. Five graphs are presented for temperature as a function of $\log^{10}_n$ for μ-values of 0.05, 0.25, 0.5, 0.75, and 1 at various optical depths. F.R.L.

A66-21211

MARINER IV OBSERVATIONS AND THE POSSIBILITY OF IRON OXIDES ON THE MARTIAN SURFACE.

Carl Sagan (Harvard University, Harvard College Observatory; Smithsonian Institution, Smithsonian Astrophysical Observatory, Cambridge, Mass.).
Icarus, vol. 5, Jan. 1966, p. 102, 103. 10 refs.
Discussion of the results produced from the flight of Mariner IV past Mars, and their indirect bearing on the study of the composition of the Martian surface. The results showed that there was no detectable magnetic field or related radiation belts, and that the surface was heavily cratered. The first result suggests that a migration of iron to the core has not occurred and that consequently there may be more iron on the Martian surface than on the terrestrial surface. The craters may be attributed to asteroid impact, indicating the possibility of meteoric iron on the surface. Original iron and subsequent meteoric iron may have oxidized as a consequence of the photo-dissociation of water vapor in the Martian atmosphere and the preferential escape of hydrogen.   F.R.L.

A66-21532
THE POSSIBLE APPLICATION OF REMOTE GEOCHEMISTRY IN PLANETARY EXPLORATION.
A. R. Barringer (Barringer Research, Ltd., Toronto, Canada).
IN: SCIENTIFIC EXPERIMENTS FOR MANNED ORBITAL FLIGHT; PROCEEDINGS OF THE THIRD GODDARD MEMORIAL SYMPOSIUM, WASHINGTON, D.C., MARCH 18, 19, 1965. [A66-21517 10-30]
Edited by P. C. Badgley.
Washington, D.C., American Astronautical Society (AAS Science and Technology Series. Volume 4), 1965, p. 303-321. 7 refs.
Proposal of a technique for the measurement of trace amounts of vapors in the lunar and terrestrial atmospheres as an indicator of biologic and geologic surface conditions. The monatomic vapors of a number of metals, iodine vapor, and sulfur dioxide are considered, and such analytical techniques as atomic absorption and molecular absorption are discussed. The facility for the spectro-photometric analysis of light reflected from the lunar and terrestrial surfaces is described and illustrated, orbital scanning modes which could be performed with the equipment are outlined and illustrated, and methods of carrying out feasibility studies are explained. B.B.

A66-21740
THE SEARCH FOR EXTRATERRESTRIAL LIFE.
N. H. Horowitz (California Institute of Technology, Jet Propulsion Laboratory, Bioscience Section, Pasadena, Calif.).
Science, vol. 151, Feb. 18, 1966, p. 789-792. 15 refs.
Examination of the Martian environment in the light of the Mariner 4 data to determine the possibilities of the existence of life on that planet. Owing to the low density of the atmosphere and the absence of a magnetic field the surface of Mars is subject to an almost unattenuated bombardment by cosmic rays and solar radiation. However, it would not be difficult for Martian organisms to be protected against this otherwise lethal barrage. The atmosphere of Mars contains approximately 1/1000 the amount of water found in the terrestrial atmosphere so that the scarcity of water is probably the most serious limiting factor for any Martian biology. The objectives and goals of Martian biological exploration are examined. The "Gulliver" culture chamber is described.   D.P.F.

A66-21773 #
EXPERIMENTAL MEASUREMENTS OF NONEQUILIBRIUM AND EQUILIBRIUM RADIATION FROM PLANETARY ATMOSPHERES.
G. M. Thomas and W. A. Menard (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.).
(AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS, ENTRY TECHNOLOGY CONFERENCE, WILLIAMSBURG AND HAMPTON, VA., OCTOBER 12-14, 1964, TECHNICAL PAPERS. AIAA Publication CP-9, p.170-185.)
AIAA Journal, vol. 4, Feb.1966, p.227-237.
Investigation of the effect of composition upon the radiation from the shock-heated mixtures: 9% CO_2/90% N_2/1% A, 30% CO_2/-70% N_2, and 100% CO_2. An electric arc-driven shock tube was used. The mixtures simulate the atmospheres of Mars and Venus. Measurements of the shock-layer radiance at the stagnation point of a

flat-faced cylinder in the 0.3- to 2.7-μ region, using a carbon-coated thin-film gage for flight velocities from 20,000 to 46,000 ft/sec and initial pressures from 0.25 to 2.0 mm Hg are described. Shock stand-off distances are measured by photographic techniques, the intensity behind the incident shock in the 0.3- to 1.0-μ region is measured by photometric techniques, and the nonequilibrium intensity in the far UV region is measured with a tungsten photoelectric gage. Shock-front-integrated nonequilibrium and equilibrium intensities, nonequilibrium relaxation distances, and time-to-peak intensity are determined. The stagnation-point radiance results are found to be higher than some current estimates, indirectly giving support to the CN radical heat of formation values obtained by Knight and Rink. The integrated nonequilibrium intensity for 9% CO_2 mixtures obtained is 55 w/cm^2-2 π ster at 25,000 ft/sec. The major radiating species are found to be the CN radical for CO_2-N_2 mixtures and the CO^+ ion for 100% CO_2. Oscillator strengths for the CN red and violet systems are deduced from the measurements. V. P.

A66-22264 #
THE COMPUTATION OF INFRA-RED COOLING RATE IN PLANETARY ATMOSPHERES.
C. D. Rodgers and C. D. Walshaw (Oxford, University, Clarendon Laboratory, Oxford, England).
Royal Meteorological Society, Quarterly Journal, vol. 92, Jan. 1966, p. 67-92. 26 refs.
Research supported by the Meteorological Office of England.
A scheme is described for the calculation of the atmospheric IR radiative cooling rate which is suitable for use at all levels. It uses the Curtis matrix method together with the Curtis-Godson approximation in a form which includes the influence of temperature on line intensity. Doppler effect is included. Because of its simplicity the Goody random model is used for all the absorption bands considered (H_2O rotation and 6.3 μ, CO_2 15 μ, O_3 9.6 μ); the use of more accurate models as they become available presents no fundamental difficulty and in any case many of the topics investigated are not particularly sensitive to the spectral model used. A method of reducing the number of spectral intervals is described and its accuracy demonstrated. An accurate method of dealing with diffuse radiation is used to test the diffuse approximation, with the result that the constant factor 1.66 originally proposed by Elsasser is found to be quite adequate for most purposes. Cooling rate errors caused by the following factors are estimated: (1) random and systematic errors in the initial temperature and humidity profiles; (2) the size of the vertical step used in computation; (3) neglecting the temperature dependence of the Curtis matrix; (4) nonlinear effects in forming climatological means. It is shown that the easily computed "cooling to space" is often a good approximation. All the error investigations are based on direct calculations of the cooling profile. Some comparisons with other techniques are presented and a number of examples of meteorological interest are used to illustrate the versatility of the computing scheme.   (Author)

A66-22458 #
IGNITION AND COMBUSTION OF POWDERED METALS IN THE ATMOSPHERES OF VENUS, EARTH, AND MARS.
R. A. Rhein (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.).
Astronautica Acta, vol. 11, Sept.-Oct. 1965, p. 322-327. 11 refs.
The ignition temperatures of a number of powdered metals have been measured in air, in a simulated Venus atmosphere (consisting, by volume, of 4.10% argon, 9.17% nitrogen, and the remainder carbon dioxide) and in a simulated Mars atmosphere (consisting, by volume, of 2.16% argon, 11.21% carbon dioxide, and the remainder nitrogen). This study was conducted to show that the atmospheres of the planets Mars and Venus could be utilized as chemical energy sources. Typical ignition temperatures of the following powdered metals were observed in the simulated Mars atmosphere: lithium, 405°C; beryllium, 762°C; calcium, 163°C; boron, 1203°C; cerium, 199°C; titanium, 916°C; zirconium, 614°C; thorium, 587°C; and uranium, 168°C. In the simulated Venus atmosphere, the following typical ignition temperatures were noted: lithium, 367°C; beryllium, earth ambient temperatures; magnesium, 676°C; calcium, 269°C; boron, 1000°C; aluminum, 705°C; cerium, 147°C; titanium, 708°C; zirconium, 152°C; thorium, 627°C; and uranium, 134°C. It was found that, generally, the powdered metals ignited more readily in

air than in the Venus atmosphere, and more readily in the Venus atmosphere than in the Mars atmosphere. These ignition temperatures were compared to those in atmospheres of pure nitrogen and pure carbon dioxide. The performance of these propellants was discussed, and it was concluded that boron and beryllium are the preferred fuels. (Author)

A66-22715
A STRATEGY FOR MARS.
Charles Richard Weston (Rochester, University, Dept. of Biology, Rochester, N.Y.).
American Scientist, vol. 53, Dec. 1965, p. 495-507. 10 refs.
Discussion of the possibilities and nature of life on Mars and an evaluation of the problems involved in its detection. Martian environmental conditions are discussed as a possible medium for the support of living organisms. The limiting effect of low temperatures, lack of water and oxygen, low atmospheric pressure, and high radiation levels on life organisms is considered. It is shown that an environment that is marginal or will not support terrestrial organisms is not necessarily unfit for organisms which could have evolved under the selective pressure of this alien environment. The problems involved in life detection experiments are analyzed. D.P.F.

A66-22786
DISK TEMPERATURES OF MERCURY AND MARS AT 3.4 MM.
Eugene E. Epstein (Aerospace Corp., El Segundo, Calif.).
Astrophysical Journal, vol. 143, Feb. 1966, p. 597,598. 6 refs.
Contract No. AF 04(695)-469.
Determination of the disk temperatures of Mercury and Mars on the basis of observations made at 3.4 mm in April 1965. A blackbody disk temperature of 190° ± 40°K is obtained for Mars, while in the case of Mercury the daily values of the blackbody disk temperature ranged from 130 to 320°K, the average value being 220 ± 35°K. A.B.K.

A66-23414 #
RECENT DEVELOPMENTS IN THE THEORY OF RADIATIVE TRANSFER IN PLANETARY ATMOSPHERES.
Zdenek Sekera (California, University, Dept. of Meteorology, Los Angeles, Calif.).
(International Association for Meteorology and Atmospheric Physics of the International Union of Geodesy and Geophysics, Symposium on Theory of Radiative Transfer in Planetary Atmospheres, Leningrad, USSR, Aug. 5-12, 1964, Paper.)
Reviews of Geophysics, vol. 4, Feb. 1966, p. 101-111. 14 refs.
Contracts No. AF 49(638)-700; No. AF 19(628)-3850.
Demonstration of the Chapman approach (based on a source matrix and on the solution of auxiliary equations for this matrix) to radiative transfer problems and particularly to the derivation of an equation for the inhomogeneous case of imperfect scattering. The integrodifferential equations for the reflection and transmission matrices for this case are presented, and their reduction is demonstrated for the separable phase matrix in which the directional parameters of the incident and scattered radiation can be separated. It is noted that with the use of the theory of singular integral equations applied to the nonlinear integral equation for X and Y function, transformed into a singular form, a method has been recently developed that permits rapidly converging iteration for large optical thickness. M.M.

A66-23503 #
NATURE OF THE CLOUD LAYER OF VENUS - FROM RADIOMETRIC OBSERVATIONS IN THE SHF RANGE [O PRIRODE OBLACHNOGO SLOIA VENERY - PO DANNYM RADIOMETRICHESKIKH NABLIUDENII V SVCh-DIAPAZONE].
A. E. Basharinov and B. G. Kutuza (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR).
(Simpozium po Radioastronomicheskim Metodam Issledovaniia Atmosfer i Poverkhnostei Planet, Puerto Rico, May 25, 1965.)
Astronomicheskii Zhurnal, vol. 43, Jan.-Feb. 1966, p. 149-153. 11 refs. In Russian.

Verification of the hypothesis of the presence of supercooled water droplets in the cloud layer of Venus. The values of absorption, obtained at a wavelength of 8 mm from measured variations of the radio brightness temperature with phases, are interpolated into the millimeter and centimeter ranges. The radio brightness temperature spectra thus obtained are found to be in fair agreement with the spectra measured on the planet's nocturnal side. The water content in the cloud layer is estimated at 0.1 to 0.3 g/cm². The radiation absorption in the layer does not exceed 1.5 and 5 Debye in the centimeter and millimeter ranges, respectively. V.Z.

A66-23504 #
SPECTROPHOTOMETRY OF METHANE ABSORPTION BANDS ON THE JOVIAN DISK IN THE NEAR INFRARED REGION (0.7 TO 1.0 μ) [SPEKTROFOTOMETRIIA POLOS POGLOSHCHENIIA METANA NA DISKE IUPITERA V BLIZHNEI INFRAKRASNOI OBLASTI (0.7 - 1.0 μ)].
V. G. Teifel' (Akademiia Nauk Kazakhskoi SSR, Astrofizicheskii Institut, Alma-Ata, Kazakh SSR).
Astronomicheskii Zhurnal, vol. 43, Jan.-Feb. 1966, p. 154-156. In Russian.
Measurement of the intensity of the methane absorption bands 7250 Å, 8610 Å + 8860 Å, and 9900 Å from spectrograms of various Jovian zones taken by an image converter tube. The absorption is slightly weaker at the planet's edge in the equatorial zone, slightly greater in the temperate latitudes, and decreases toward the poles. The variations are far smaller than those from a conventional secant effect in a single-layer model of an absorbing atmosphere. Theories are proposed to explain these zonal variations. V.Z.

A66-23639
LUNAR AND PLANETARY PROBES - METEOROLOGY AND COMMUNICATIONS - GEODESY AND NAVIGATION.
Harrie Massey (London, University, University College, Dept. of Physics, London, England).
(Contemporary Physics, vol. 6, Apr. 1965, p. 241-260.)
IN: SPACE TRAVEL AND EXPLORATION.
H. S. W. Massey (London, University, University College, Dept. of Physics, London, England).
London, Taylor and Francis, Ltd., 1966, p. 73-92.
[For abstract see issue 04, page 575, Accession no. A66-13361]

A66-23640
EXOBIOLOGY - MAN IN SPACE.
Harrie Massey (London, University, University College, Dept. of Physics, London, England).
(Contemporary Physics, vol. 6, June 1965, p. 321-337.)
IN: SPACE TRAVEL AND EXPLORATION.
H. S. W. Massey (London, University, University College, Dept. of Physics, London, England).
London, Taylor and Francis, Ltd., 1966, p. 93-109.
[For abstract see issue 04, page 469, Accession no. A66-13806]

A66-23660
MARS - UPPER ATMOSPHERE.
S. H. Gross (Cutler-Hammer, Inc., Airborne Instruments Laboratory Div., Melville, N.Y.), W. E. McGovern (New York University, School of Engineering and Science, Dept. of Meteorology and Oceanography, Bronx, N.Y.), and S. I. Rasool (NASA, Goddard Space Flight Center, Goddard Institute for Space Studies, New York; New York University, School of Engineering and Science, Dept. of Meteorology and Oceanography, Bronx, N.Y.).
Science, vol. 151, Mar. 11, 1966, p. 1216,1221. 9 refs.
Grant No. NsG-499.
Theoretical analysis of the thermal structure of the upper atmosphere of Mars, based on spectroscopic measurements and the results of the Mariner-4 occultation experiment. Based on a pure CO₂ model with a surface pressure of 5 to 10 mb, the exospheric temperature is calculated to be 550 ±150°K. The vertical temperature distribution, which is plotted, is consistent with the temperatures deduced from the Mariner experiment. The implications of these results for the origin of the Martian atmosphere are considered significant. R.A.F.

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A66-23794 #

EVIDENCE OF EXTRATERRESTRIAL LIFE [ÜBER DEN NACHWEIS
EXTRATERRESTRISCHEN LEBENS].
Hans Swart.
Astronomie und Raumfahrt, no. 6, 1965, p. 161-171. 10 refs.
In German.

Review of work currently being done to determine whether extra-
terrestrial life exists in the solar system. Only Mars is considered
capable of supporting even lower forms of life. Various automatic
systems currently being developed in the U.S. for use with the Voy-
ager spacecraft are intended to soft-land on the Martian surface,
gather dust samples from the Martian atmosphere, or collect sam-
ples of the Martian soil and examine them for microorganisms. The
furthest developed of these systems are the "Gulliver" radioisotope
experiment, the "Multivator" automatic biochemical testing apparatus,
and a TV-microscope. The first launch attempt is expected to be with
a Saturn-1B/Centaur, not before 1969.   R. A. F.

A66-24697 #

LANDER PAYLOAD INCREASE BY BETTER DEFINITION OF THE
MARS ATMOSPHERE.
Ernest J. Merz (General Electric Co., Missile and Space Div.,
Philadelphia, Pa.).
(American Institute of Aeronautics and Astronautics, Aerospace
Sciences Meeting, 2nd, New York, N.Y., Jan. 25-27, 1965,
Paper 65-22.)
Journal of Spacecraft and Rockets, vol. 3, Mar. 1966, p. 359-364.
5 refs.
[For abstract see issue 05, page 670, Accession no. A65-14563]

1965

LC ENTRIES

A65-80370
ATMOSPHERE AND EVOLUTION.
Daniel L. Gilbert (Jefferson Med. Coll., Dept. of Physiol., Philadelphia).
IN: OXYGEN IN THE ANIMAL ORGANISM.
(Symposium of the International Union of Biochemistry and the International Union of Physiological Sciences, London, 1963, Proceedings.)
Edited by Frank Dickens and Eric Neil.
Oxford, Great Britain, Pergamon Press, 1964, p. 641-655. 61 refs.
[See A65-80355].

A biosphere might possibly exist on a planet during the time its atmosphere evolved from one composed of molecular hydrogen, helium, water, methane, and ammonia into one composed of carbon dioxide and molecular nitrogen. In the beginning and ending of such a possible life-stage on a planet, the atmosphere could be expected to contain little or no molecular oxygen. The formation of water by the marriage of oxygen, the second most abundant chemically reactive cosmic element, to hydrogen, the predominant cosmic element, is the essential source of energy for most of the earth's biosphere. The destructive influence of this energy source on the biosphere is reflected in the phenomenon of oxygen toxicity.

A65-80473
STAGES AND MECHANISMS OF PREBIOLOGICAL ORGANIC SYNTHESIS.
J. Oro (Houston U., Dept. of Chem., Tex.)
IN: THE ORIGINS OF PREBIOLOGICAL SYSTEMS AND OF THEIR MOLECULAR MATRICES: Proceedings of a Conference Conducted at Wakulla Springs, Fla. on 27-30 Oct. 1963.
Edited by Sidney W. Fox.
New York, Academic Press, 1965, p. 137-162. Discussion p. 162-171. 58 refs.
NASA Grant NsG-257-62.

Observations on the composition of carbon star atmospheres, interstellar matter, the Jovian planets, comets, and meteorites indicate that the synthesis of organic compounds in the universe is a more general process than has been thought heretofore. Prior to and during the formation of the solar system, but before the earth was completely formed, organic syntheses probably occurred in the following four stages (or sites): carbon star atmospheres, solar nebula, planetesimals, and protoplanets. The energy for these syntheses was provided initially by the high temperature of star atmospheres and then mainly by the ionizing radiation and ultraviolet light coming from the sun. Catalytic processes and other localized sources of energy were probably also involved in the formation of organic compounds. Astronomic and meteoritic observations indicate that the conditions prevailing in the majority of cosmic bodies during the latter stages of evolution of the solar system were as follows: reducing or oxygen-free atmosphere, aqueous environment, basic or neutral pH, moderate temperature, and presence of a relatively high concentration of organic compounds. A number of general mechanisms can be postulated to have been involved in the abiotic formation of simple biochemical compounds: (a) a radical mechanism in the synthesis of the aliphatic and aromatic aldehydes which are the precursors of α -amino acids, (b) a base-catalyzed aldol condensation of simple aldehydes in the formation of pentoses, 2-deoxypentoses, and other monosaccharides, and (c) a base-catalyzed condensation of hydrogen cyanide and other nitriles, followed by other condensation reactions, in the synthesis of purines, pyrimidines, and other heterocyclic compounds.

A65-80868
THE ATMOSPHERE OF VENUS.
Carl Sagan (Harvard U., Cambridge, Mass.)
IN: THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS.
(Conference at Goddard Institute for Space Studies, National Aeronautics and Space Administration, New York, April 8-9, 1963, Proceedings).
Edited by Peter J. Brancazio and A. G. W. Cameron.
New York, John Wiley and Sons, Inc., 1964, p. 279-288. 11 refs.

Data attempting to explain the composition of the atmosphere of Venus are reviewed. Problems with respect to water vapor, CO_2, organic molecules, temperature, and pressure are included. An explanation of how the surface stays as hot as it does is one of the key problems in understanding the Venus environment. There is as yet no view which integrates all of the observational material.

A65-80869
THE ATMOSPHERE OF MARS.
Richard M. Goody (Harvard U., Cambridge, Mass.)
IN: THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS.
(Conference at Goddard Institute for Space Studies, National Aeronautics and Space Administration, New York, April 8-9, 1963, Proceedings).
Edited by Peter J. Brancazio and A. G. W. Cameron.
New York, John Wiley and Sons, Inc., 1964, p. 289-298. 6 refs.

Some difficulties in determining the composition, ground pressure, and structure of the atmosphere of Mars are presented. Included are both solid and inferential data. Among the former are polarimetric measurements of the total mass of the Martian atmosphere and spectrographic measurements for oxygen and water vapor. The latter covers Martian polar caps, atmospheric oxygen content, and atmospheric nitrogen content. Surface features of Mars that could have some relevance to atmospheric processes, insofar as there is some kind of interchange between the surface and atmosphere, are also included.

A65-80889
THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS.
Peter J. Brancazio and A. G. W. Cameron.
Edited by Peter J. Brancazio and A. G. W. Cameron (Goddard Inst. for Space Studies, New York, N. Y.)
(Conference at Goddard Institute for Space Studies, National Aeronautics and Space Administration, New York, April 8-9, 1963, Proceedings).
New York, John Wiley and Sons, Inc., 1964, xii +314 p. (See A65-80890 to A65-80891). $12.50.

Various aspects of the origin and evolution of planetary atmospheres and oceans as discussed by a group of physicists, astronomers, and earth scientists on April 8 and 9, 1963, at the Goddard Institute for Space Studies, are presented. Included are the following: (1) geologic history of sea water, (2) convection in the earth's mantle, (3) degassing of argon and helium from the earth, (4) comments on the outgassing of the earth, (5) on the chemical evolution of the terrestrial and cytherean atmospheres, (6) the history of growth of oxygen in the earth's atmosphere, (7) the escape of helium from the earth's atmosphere, (8) primordial rare gases in meteorites, (9) isotopic analysis of xenon, (10) interpretation of xenon measurements, (11) outgassing processes on the Moon and Venus, (12) observations of water vapor on Mars and Venus, (13) the atmosphere of Mercury, (14) the atmosphere of Venus, (15) the atmosphere of Mars, (16) are the interiors of Jupiter and Saturn hot ?, and (17) the atmosphere of Jupiter. A subject index is included.

A65-80890
ON THE CHEMICAL EVOLUTION OF THE TERRESTRIAL AND CYTHEREAN ATMOSPHERES.
Heinrich D. Holland (Princeton U., N. J.)
IN: THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS.
(Conference at Goddard Institute for Space Studies, National Aeronautics and Space Administration, New York, April 8-9, 1963, Proceedings).
Edited by Peter J. Brancazio and A. G. W. Cameron.
New York, John Wiley and Sons, Inc., 1964, p. 86-101. 11 refs. (See A65-80889).

The history of the terrestrial atmosphere as related to accepted data concerning the chemical composition of the atmosphere of Venus is presented. Included are data of the partial pressure of oxygen in the atmosphere as function of time throughout the history of the Earth. The influence of the latter on partial pressures of N_2, A Ne, Kr, Ke, CO_2, and SO_2 is described. The presence of water on the Earth's surface must be related to the inclusion of water in the solid part of the Earth during accretion, most probably as ice and as water of hydration in hydrated silicates. The relative water content of accreted planetary material is therefore surely related to the temperature during accretion. It seems likely that the temperature during accretion in the orbit of Venus was higher than that in the Earth's orbit; the water content of Venus could therefore be considerably smaller than that of the Earth. The mean depth of the Earth's oceans is about 3000 meters and is a function of the water content of the lithosphere and of the degree of degassing of the planet. If the water content of Venus were three to four

A65-80891
OBSERVATIONS OF WATER VAPOR ON MARS AND VENUS.
A. Dollfus (Observatoire de Paris, Meudon, France).
IN: THE ORIGIN AND EVOLUTION OF ATMOSPHERES AND OCEANS.
(Conference at Goddard Institute for Space Studies, National Aeronautics and Space Administration, New York, April 8-9, 1963, Proceedings).
Edited by Peter J. Brancazio and A. G. W. Cameron.
New York, John Wiley and Sons, Inc., 1964, p. 257-268. (See A65-80889).

Descriptions of new measurements giving positive identification of water on both Venus and Mars are presented. Observations were made from balloons during flight and from high mountains. Data were obtained by making

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photometric comparisons of the observations on Venus and Mars with those on the Sun or Moon. A final value of 1.5×10^{-2} g/cm^2 of water vapor was calculated to be about 1×10^{-2} g/cm^2, with a probable error of a factor of 2. Activities of an international program for photographing Venus in the ultraviolet are described.

A65-80977
HABITABLE PLANETS FOR MAN.
Stephen H. Dole (Rand Corp., Santa Monica, Calif.)
New York, Blaisdell Publishing Co., 1964, |xiii + 158 p.
$5.75.
This book attempts to spell out the requirements of planets on which human beings as a biological species can live, and to discuss the essential properties required of the stars which provide heat and light. The nine chapters deal with space and the solar system, human requirements (temperature, light, gravity, water, atmospheric composition, and pressure), physical properties of the planets, probability of occurrence of habitable planets, discussion of the 43 stars with a reasonable likelihood of having habitable planets, and changes affecting men in new environments. A 6-page appendix contains physical data on the 25 principal bodies of the solar system of mass greater than 10^{23} grams.

A65-81013
SOME EARTH LIFE SEEN ADAPTABLE TO MARS.
Roderick D. Hibben.
Aviation Week and Space Technology, vol. 82, Apr. 12, 1965, p. 71–79.
There is evidence that certain plants, insects, and primitive animal organisms found on earth could survive the temperature extremes and low-oxygen environment thought to exist on Mars. There seems to be a direct correlation between the ability of a chemical compound which acts as a plant growth accelerating hormone and the activity outside the living plant of the compound as a chemical antioxidant. The chemistry and development of preexisting life forms on earth and those which might exist on neighboring planets may have been similar. Laboratory tests showed that plants could survive a reduced oxygen atmosphere. However, their chemistry was greatly changed. Under thermal variations which are thought to exist on Mars, the plants had vegetative reproduction, but no floral reproduction was observed. Desert species died but the roots produced young shoots. Meal worm larvae showed a longer period of survival than pupae and adult invertebrates. Red-ear turtles survived but their red-count did not increase, as in the case in humans, and blood volume decreased below effective circulation requirements. In most cases 1% to 5% oxygen was sufficient to support activity of many adult insects. However, because any liquid water present on Mars may have high salinity, many forms of life would be ruled out. Fungi could survive and reproduce in an environment almost devoid of oxygen and water. Some lichens have been found to survive 4000 times the normal ultraviolet radiation received on earth and temperatures of -30° F. Molds and a variety of bacteria are able to grow in pure ammonia or a mixture of ammonia and methane.

A65-81018
MARS.
Robert S. Richardson and Chesley Bonestell.
New York, Harcourt, Brace and World, Inc., 1964, viii+151 p. $8.50.
If there is extraterrestrial life in the solar system, Mars is the only planet for which we have the slightest evidence. In this book on Mars, there are discussions of the physical characteristics of the planet; probability of life; orbital characteristics and distance from Earth; time measures, seasons, and atmosphere on the planet; vegetative and nonvegetative hypotheses of visible changes; origin of the canals; problems and dangers of habitation; gravitational attraction; and characteristics of the Martian satellites, Phobos and Deimos.

A65-81159
IS THERE VEGETATION ON MARS?
R. Smoluchowski (Princeton U., Solid State and Materials Program, N.J.)
Science, vol. 148, May 14, 1965, p. 946–947. 10 refs.
NSF and Higgins Fund supported research.
At least some of the changes in the color of Mars at different seasons are caused by color centers produced by electromagnetic and corpuscular solar radiation in solids on the surface. Calculated radiation flux, at appropriate energies and known temperature variation, could account for seasonal formation of color centers and bleaching if a simple trap model is assumed. In certain kinds of rhyolite (SiO_2, $NaAlSi_3O_8$), which has been suggested as one of the possible constituents of the martian surface, color centers can be produced. No color centers are expected in limonite, $Fe_2O_3 \cdot 3H_2O$, the other likely constituent.

A65-81287
SURVIVAL AND GROWTH OF TERRESTRIAL MICROORGANISMS IN AMMONIA-RICH ATMOSPHERES.
S. M. Siegel and C. Giumarro (Union Carbide Res. Inst., Tarrytown, N.Y.)
Icarus, vol. 4, Apr. 1965, p. 37–40. 9 refs.
Contract NASw-767.
Various bacteria, and ascomycetes were demonstrated to have grown on specimens of Euphorbia xylophylloides and other xerophytes after 2 months in atmospheres containing NH_3 with CH_4, H_2, or air. NH_3 levels of at least 50,000 ppm far exceeded conventional upper safe limits for human toxicity. Extreme performance was shown by a stress-adapted Penicillium brevicompactum which grew slowly in 95% NH_3/5% CH_4. The significance of these observations for the origin and current existence of microbial life on Jupiter is noted briefly.

A65-81737
A PHYSICAL BASIS FOR LIFE DETECTION EXPERIMENTS.
J. E. Lovelock.
Nature, vol. 207, Aug. 7, 1965, p. 568–570. 19 refs.
NASA Grant NSG 199-62.
The design of an efficient and unequivocal experiment in extra-terrestrial life detection should take into account a definition of life stated in terms favorable for its recognition, and a description of the past and present environment of the planet to be sampled. The following experiments are suggested for the detection of life, specifically on Mars: (1) search for order in chemical structures and molecular weight distributions, also by sound and by sight; and (2) search for non-equilibrium, principally by differential thermal analysis and gas chromatography mass spectrometry of the atmosphere, and recognition of physical non-equilibrium such as non-random motion. A description of past and present known conditions on Mars is included.

A65-81928
THE ORIGIN OF PLANETARY ATMOSPHERES.
A. G. W. Cameron.
(Goddard Space Flight Center, Inst. for Space Studies, Beltsville, Md.)
TRW Space Technology Laboratories Lecture Series, vol. 2, 1965, p. 61–70.
The author lists the processes which may be important in the formation and regulation of planetary atmospheres. The input processes may consist of: (1) capture of gaseous matter from primitive solar nebulae or solar winds, (2) result of collisions with comets and meteorites; (3) outgassing from the interior; and (4) chemical reactions with surface matter. The loss of atmosphere may be due to: (1) thermal evaporation; (2) sweeping action of solar wind; (3) chemical reactions with surface materials; and (4) rotation instability of the planet. The author considers the effects of these processes on the existing or speculated composition of atmospheres which surround the solar planets and the moon. The author concludes that we have no knowledge how important these various processes are for the majority of planets, nevertheless, this outline provides a framework for discussion of various planetary atmospheres.

A65-82064
INSTRUMENTS FOR DETECTING LIFE.
William R. Corliss.
IN: SPACE PROBES AND PLANETARY EXPLORATION.
New York, D. Van Nostrand Co., Inc., 1965, p. 477–502. 25 refs. NASA supported research $7.50.
This handbook of technical information on space and planetary exploration, spacecraft design, communications, guidance, and scientific instruments in space is intended for use by engineers and others engaged in space exploration, ventures. Pertinent to aerospace medicine is Chapter 16, in which are reported techniques for the detection and study of life on other planets. Instruments to be used for the detection and study include infrared and mass spectrometers, television, radio listening, chromatographs, and ultraviolet spectrophotometers. Biological experiments should include the determination of staining properties, reduction-oxidation potentials, bioluminescence and optical rotary dispersion, plus microscopic observation and metabolism detection by means of radioisotopes. Life detection and study may be done by either remote analysis or by sample analysis.

A65-82218
AUTOMATED LIFE DETECTION
Richard S. Young (NASA, Ames Res. Center, Exobiol., Div., Moffett Field, Calif.)
Astronautics and Aeronautics, vol. 3, Oct. 1965, p. 70–78.
Possible means for exploring extraterrestrial bodies and for studying their biological and physical evolution are discussed. Mars continues to offer the greatest potential for biological activity and to command the most interest

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from the scientific community for its physical, geological, and chemical characteristics. The most familiar environmental factors of Mars suggesting biological possibilities are: (1) atmosphere, (2) radiation, (3) surface composition, (4) pole caps, (5) dark and light regions, (6) clouds, (7) temperature, (8) pressure, (9) water, (10) Sinton bands suggesting presence of carbon compounds on Mars' surface, and (11) microenvironments. The manifestations of life most often listed as demonstrating unequivocally the existence of extraterrestrial life are growth, movement, irritability, reproduction, and metabolism. Chemical composition is generally included as a characteristic of living things. The selection of life-detection instrumentation must consider those experiments which are most indicative of life as opposed to those likely to give informative results. The urgency of life detection before planetary contamination by terrestrial organisms requires an experimental package that is sterile, lightweight, automatic, and fully integrated.

A65-82273
THE ABSORPTION INTENSITY OF THE $5_{\nu 3}$ BAND OF CARBON DIOXIDE, AND THE MARTIAN CO_2 ABUNDANCE AND ATMOSPHERIC PRESSURE.
Philip L. Hanst and Paul R. Swan (AVCO Corp., Res. and Advan. Develop. Div., Wilmington, Mass.)
Icarus, vol. 4, Sep. 1965, p. 353–361. 9 refs.

The surface pressure of the Martian atmosphere strongly affects the design and payload capabilities of Mars entry vehicles. The current most widely accepted value of this surface pressure is 25 millibars. This value was determined by Kaplan, Münch, and Spinrad based on their observation of CO_2 absorption lines near 8700 Å and on Sinton's and Kuiper's CO_2 observations at 2.06 microns. It is noteworthy that their estimated value of 25 millibars is a factor of 3 or 4 below estimates determined both by photometric and by polarimetric techniques. A laboratory redetermination of the integrated absorption intensity of the $5_{\nu 3}$ band of CO_2 near 8700 Å has been made with a long-path technique and photomultiplier detection. This has resulted in a revision of the calibration used by Kaplan, Münch, and Spinrad. In view of the importance of the surface pressure to current studies of Mars probes, a recalculation of the pressure utilizing the new laboratory measurements is carried out in this paper. The results of the present analysis give a revised value of (31 ± 13) m-atm. for the Martian CO_2 abundance under the assumption of an effective temperature for the Martian atmosphere of $200°$ K. The surface pressure is now estimated, using this abundance value, to be (51 ± 25) millibars.

1966

LC ENTRIES

A66-80582
LIFE ON MARS.
Francis Jackson and Patrick Moore.
London, Routledge and Kegan Paul, 1965, ix + 111 p. 106 refs.

The author reviews the facts available at present on the conditions existing on the planet mars, in order to decide whether human, animal, and plant life, as it is known on earth, would be possible on this planet. His conclusion is that some primitive forms of terrestrial life could survive the martian atmosphere, which has a different composition than the atmosphere surrounding earth. The diurnal variation of martian temperature is more extreme than on earth, and it could be fatal to terrestrial organisms but some could adapt to these rigorous conditions. The possibility of the existence of martian organisms would call for assuming a different biochemical system. The presence of seasonal changes of martian surface coloring suggest the presence of photosynthetic plants, but it is evident that the overall martian surface conditions are not suitable for human life support.

A66-80742
SPACE AND INTELLIGENT BEINGS (KOSMOS I RAZUMNYE SUSHCHESTVA).
F. A. Tsitsin (P. K. Shternberg State Inst. of Astronomy, Moscow, USSR).
Priroda, no. 11, Nov. 1965, p. 94–101. In Russian.

The physical factors are considered which control the state of the visible universe, primarily, temperature, presence of atmosphere enveloping a planet and existing force of gravity on a planet. These factors are important in the formation of macromolecules from which life can evolve. Assumption that only one out of 10^5–10^6 stars can provide the center of a system similar to the solar system, creating planetary conditions suitable for supporting life, is, according to the author, an underestimation. Some mathematical considerations indicate a greater probability of the existence of extraterrestrial life.

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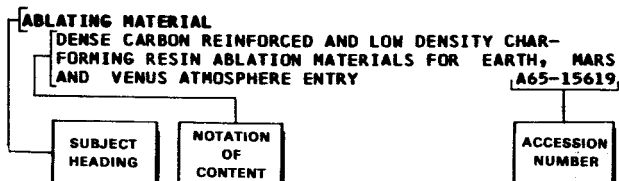
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A Notation of Content (NOC), rather than the title of the document, is used to provide a more exact description of the subject matter. In order to provide the user with more than one approach in the search for specific information, a subject may be listed under several subject headings. The accession number is included to assist the user in locating the abstract in the abstract section.

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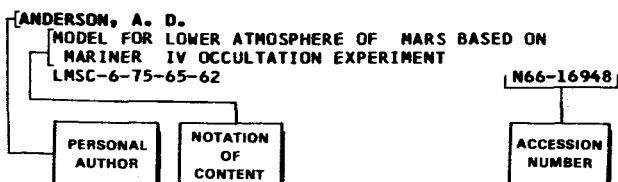SOFT X-RAY REGIONS OF SOLAR SPECTRUM
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